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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Appl. No.	:	10/015,811
Applicants	:	Thomas M. Graettinger, et al.
Filed	:	November 2, 2001
TC/A.U.	:	2811
Examiner	:	Shouxiang Hu
Title	:	ELECTRICAL CONTACT FOR HIGH DIELECTRIC CONSTANT CAPACITORS AND METHOD FOR FABRICATING THE SAME
Docket No.	:	MICRON.083C1
Customer No.	:	20,995

Confirmation No. : 1296

Express Mailing Certification

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May 26, 2004
(Date)

John M. Grover, Reg. No. 42,610

ON APPEAL TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The Appellants appeal the rejection of Claims 78-89, which were rejected in the Final Office Action dated November 28, 2003 in the above-captioned patent application.

This Appeal Brief is filed in **triplicate** including Appendix A, which is a copy of the claims involved in this Appeal, Appendix B, which is a copy of the references cited in this Appeal, and Appendix C, which is a copy of the Federal Circuit cases cited in this Appeal. Moreover, this Appeal Brief is filed with an accompanying Amendment filed in **triplicate**.

An oral hearing is hereby requested.

A check in the amount of $600 is included to cover the fee of $320 for filing an Appeal Brief pursuant to 37 C.F.R. § 1.17(c) and the fee of $280 for an oral hearing before the Board pursuant to 37 C.F.R. § 1.17(d). According to the rules of 37 C.F.R. § 1.192, the Appellant's Brief is as follows.

(1) REAL PARTY IN INTEREST

The real party in interest is the assignee, Micron Technology, Inc.

(2) RELATED APPEALS AND INTERFERENCES

The Appellants know of no other appeals or interferences which will directly affect, be directly affected by, or have a bearing on the Board's decision in this Appeal.

(3) STATUS OF THE CLAIMS

Claims 84-89 as Shown in the Attached Amendment Remain Pending for Appeal

Claims 78-89 were pending at the time of the November 28, 2003 Office Action. On March 1, 2004, the Appellants filed an After Final Amendment, canceling Claims 78-83 (half of the claims) and amending Claims 84-88 according to the Examiner's recommendations in the Final Office Action, i.e., replacing "barrier to corrosion" with --barrier against corrosion--, removing objectionable language, and replacing "surrounding" with --covering-- in Claim 88.

In an Advisory Action issued on March 18, 2004, the Examiner refused to enter the March 1, 2004 After Final Amendment. Therefore, in accordance with 37 C.F.R. § 1.192(c)(9), attached Appendix A includes a copy of Claims 78-89 as they were examined at the time of the November 28 Office Action. However, in an effort to reduce the issues on appeal, the Appellants submit herewith an Amendment that seeks to cancel claims and adopt the Examiner's recommendations. The remainder of the present Appeal Brief will proceed as if the requested cancellations and amendments were entered in accordance with M.P.E.P. § 1207 (stating, "Except where an amendment merely cancels

claims and/or adopts examiner suggestions, removes issues from appeal, or in some other way requires only a cursory review . . ., compliance with . . . 37 CFR. 1.116 will be expected . . . ." Emphasis Added).

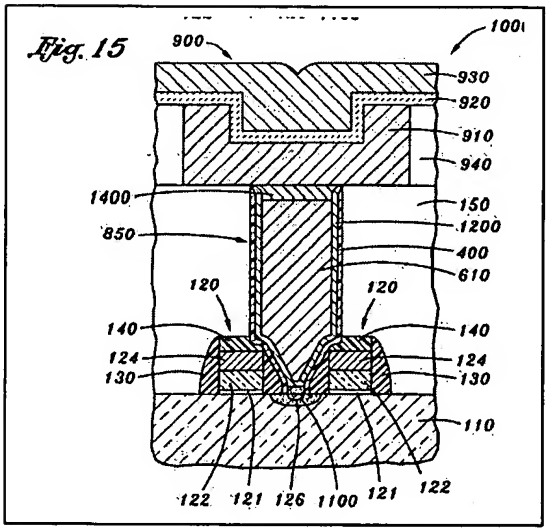
Accordingly, Claims 84-89, in the form presented in the accompanying Appellants' Amendment, remain pending for appeal.

(4) STATUS OF THE AMENDMENTS

As disclosed in paragraph (3) above, an Advisory Action of March 18, 2004, indicated that for purposes of this Appeal, the March 1, 2004 After Final Amendment would not be entered. However, accompanying the present Appeal Brief, the Appellants have filed an Amendment that cancels Claims 78-83, and that amends Claims 84-88 as directed by the November 28, 2003 Final Office Action.

(5) SUMMARY OF THE INVENTION

As discussed in the Appellants' specification, use of high dielectric constant capacitors typically involves highly oxidizing ambients during manufacturing processes. These ambients often cause oxidation problems with respect to the conductive electrical contact material between the active areas of the silicon substrates and the capacitors. The application teaches that it is highly advantageous to surround the electrical contact with both insulating and conductive oxidation-resistant (or diffusion barrier) spacers.



In one disclosed embodiment highlighted in the adjacent reproduction of Fig. **15** of the application, the memory cell **1000** includes layers forming a capacitor **910**, **920**, **930** capable of storing information, an active layer **126**, and a contact plug **610**, which electrically connects the capacitor to the active layer. Fig. **15** also shows the conductive diffusion barrier layers **1100**, **1200**, **1400**, that surround the conductive filler of the

contact plug **610**, to protect the conductive filler from deterioration and possibly failure. For example, the conductive diffusion barrier layers advantageously block harmful diffusion of, for example, oxygen, dopants, or the like, resulting from the highly oxidizing manufacturing processes of memory cells. In addition, Fig. **15** shows a non-conductive diffusion barrier layer **400** surrounding the sidewalls of the conductive diffusion barrier layer **1200**, thereby forming a double layered diffusion barrier that provides additional protection against the foregoing harmful diffusions.

Fig. **15** also illustrates the memory cell including bit lines **120** that, among other things, provide communication with the capacitor **910**, **920**, **930** of the memory cell. In the embodiment of Fig. **15**, the bit lines **120** are formed using a reduction in processing steps referred to as "self alignment." In other words, the processing mask that defines where the contact **610** will be placed need not be precisely aligned with and may be wider than the gate spacing.

Use of the claimed double layered diffusion barrier however is not intuitive. For example, because it requires additional processing steps and additional space, without increasing memory capacity, the recited double layering is in **direct contrast** to the common goal of the memory cell industry, that of maximizing memory resolution (amount of storage space) while minimizing memory size (footprint) and memory cell processing steps.

In the present application, Independent Claim 84 recites, among other things, the conductive and insultative sidewall layers forming the double layered diffusion barrier that, among other things, effectively protects the contact plug from harmful diffusions. Dependent Claim 85 recites the conductive cap, Dependent Claim 86 recites the conductive base, and Dependent Claim 87 recites both the cap and the base. Dependent Claim 88 recites the bit line, and Dependent Claim 89 recites the self alignment.

(6) ISSUES PRESENTED ON APPEAL

Whether Claims 84-88 are properly rejected under 35 U.S.C. § 103(a) as being unpatentable over WIPO Publication No. WO98/15013, issued to Hartner et al., (the

"Hartner publication[1]") in view of U.S. Patent No. 4,926,237, issued to Sun et al., (the "Sun patent"), and whether Claim 89 is properly rejected under 35 U.S.C. § 103(a) as being unpatentable over the Hartner publication in view of the Sun patent and U.S. Patent No. 5,346,844, issued to Cho et al. (the Cho patent).

(7) GROUPING OF CLAIMS

For the purpose of this appeal, Claims 84-89 can be grouped together and Claim 84 can be treated as a representative claim.

(8) ARGUMENTS

The final Office Action rejected Claims 84-88 under 35 U.S.C. § 103(a) as being unpatentable over the Hartner publication in view of the Sun patent. The Final Office Action added the Cho patent to the foregoing rejection in order to allege obviousness with respect to Claim 89.

To maintain an obviousness rejection under § 103(a), three requirements must be met:

> To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on the Applicant's disclosure. See M.P.E.P. § 2143.

The Appellants respectfully submit that in the present case, the combination of the Hartner publication and the Sun patent is improper because, among other things, without

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[1] For ease of understanding, the Appellants will reference the Hartner patent, U.S. Patent No. 6,043,529, which according to the Examiner, is the English version of the Hartner publication

knowledge of the presently claimed invention, neither the references nor knowledge available to an artisan supply a motivation to make the combination.

The Combination of the Hartner publication and the Sun patent is Improper Because Without Knowledge of the Presently Claimed Invention, Neither the References Nor Knowledge Available to an Artisan Supply a Motivation to Make the Combination

Recently, the Federal Circuit addressed the concern of using hindsight, e.g., the Appellants' own disclosure, in obviousness-type rejections. In *In re Dembiczak*, the Federal Circuit warned against **using the inventor's disclosure** of Halloween faces on trash bags, **as a blueprint for combining** teachings of crepe paper jack-o-lanterns with teachings of placing faces on paper bags **without evidence of a suggestion, teaching or motivation in the prior art**. 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999) (abrogated on other grounds by *In re Gartside*, 203 F.3d 1305, 53 U.S.P.Q.2d 1769 (Fed. Cir. 2000)). Shortly after *Dembiczak*, the Court in *In re Kotzab*, explained that "particular findings must be made as to the reason the skilled artisan, **with no knowledge of the claimed invention**, would have selected these components for the combination in the manner claimed." 217 F.3d 1365, 1371, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000) (emphasis added). Failure to have such particular findings led the Court to overturn an Examiner's and a Board's findings of obviousness. More recently, the Court in *In re Lee*, vacated a ruling by the Board of Patent Appeals and Interferences, stating that it was improper, in determining whether a person of ordinary skill would have been led to a particular combination of references, simply to use that which the inventor taught against its teacher. 277 F.3d 1338, 1344, 61 U.S.P.Q.2d 1430, 1434 (Fed. Cir. 2002).

As in *Dembiczak*, *Kotzab*, and *Lee*, the Examiner in the present application fails to provide an acceptable motivation to combine the Hartner publication with the Sun patent. For example, in the present application, independent Claim 84 recites, among other things, a method comprising forming a first barrier against corrosion; forming a second barrier against corrosion comprising conductive material; and forming a conductive contact plug. Additionally, Claim 84 recites that the second barrier is around the conductive contact plug and the first barrier is around the second barrier, thereby forming an electrical

contact including at least two protective barriers around the conductive contact plug to avoid corrosive aspects associated with fabrication.

In contrast to the claimed double wrapped contact plug, the Hartner publication does not teach or suggest implementing a second barrier that comprises conductive material. This lack of teaching is recognized in the Final Office Action, on page 7, paragraph 1. However, the Final Office Action asserts that the combination of a conductive wrapped contact plug from the Sun patent would be obvious in order to make "a semiconductor device with better protection to the contact plug" The Applicants submit that the such motivation is improper for a number of reasons including (1) the Final Office Action misconstrues the teaching of the Sun patent, and (2) the motivation is in direct contrast with the industry standard of seeking smaller device footprints using less process steps.

The Final Office Action rationalizes the combination of the Sun patent by alleging that the Sun patent discloses a contact plug 28 inside a dielectric layer 16 that may include Silicon Nitride (SiN), the material of Hartner's SiN insulative liner. However, Sun's dielectric layer 16 is only an interlevel dielectric space filler common to virtually all semiconductor devices and is not a barrier against corrosion.

Thus, the Hartner publication stands alone with its teaching of a SiN insulative liner, and the Sun patent stands alone with its teachings of a Titanium (Ti) or Titanium Nitride (TiN) conductive liners, with no motivation in either reference to combine each other. Rather, industry pressures to minimize device footprints and reduce extra processing steps are in **direct contrast** to any combination of the two references. This is especially true when considering the stated motivation, ostensibly to better protect the contact plug, when each reference provides its own **independent solution** to protecting its contact plug.

In short, a skilled artisan having the Hartner publication and also having **no knowledge of the claimed invention**, would not look to or add the additional space and the additional processing steps of the Sun patent to solve a problem already solved by the

Hartner publication. The Appellants therefore submit that the Final Office Action fails to present a *prima facie* case of obviousness against independent Claim 84.

The Appellants also submit that Claims 85-88, which depend from Claim 84, are patentable for the same reasons articulated above with respect to Claim 84, and because of the additional features recited therein. Moreover, the Appellants submit that the Cho reference does not supply the missing motivation for the foregoing combination. Rather, the Cho reinforces the above-mentioned industry goals by focusing on minimizing the layout or footprint occupied by the conductive structure being formed (also discussed as maximizing the resolution thereof). *See* col. 1, line 49 through col. 2, line 7. Accordingly, the Appellants also submit that Claim 89, which depends from Claim 84, is patentable for the same reasons articulated above with respect to Claim 84, and because of the additional features recited therein.

(9) CONCLUSION

Because the combination of the Hartner publication with the Sun patent (or in the case of Claim 89, with the Sun and Cho patents) is improper, Claims 88-89 are not properly rejected under 35 U.S.C. § 103(a). Accordingly, the Appellants respectfully request withdrawal of the rejections of Claims 84-89, and respectfully request allowance of the same.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: May 26, 2004 By:

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APPENDIX A

This Appendix A contains a copy of the claims involved in this Appeal according to 37 C.F.R. § 1.192(c)(9).

Claim 78 (**Previously Presented**) A method of protecting conductive elements of an integrated circuit, the method comprising:

forming an insulating barrier liner covering at least one gate formed on a lower circuit element;

forming a silicon nitride barrier liner which will surround a conductive connector; and

forming the conductive connector which electrically connects an upper circuit element to the lower circuit element, thereby protecting the conductive connector from corrosive effects associated with fabrication of the upper circuit element, wherein the insulating barrier liner contacts the silicon nitride barrier liner.

Claim 79 (**Previously Presented**) The method of Claim 78, wherein portions of the gate contact the silicon nitride barrier liner.

Claim 80 (**Previously Presented**) The method of Claim 78, wherein the insulating barrier liner comprises silicon nitride.

Claim 81 (**Previously Presented**) The method of Claim 78, further comprising forming a conductive barrier liner which surrounds the conductive connector, wherein sidewalls of the conductive barrier liner are between the silicon nitride barrier liner and the conductive connector and a cap portion of the conductive barrier liner is above the conductive connector and forms part of the electrical connection between the upper circuit element and the lower circuit element.

Claim 82 (**Previously Presented**) The method of Claim 78, wherein the upper circuit element comprises a capacitor including a dielectric material having a dielectric constant greater than about 10.

Claim 83 (**Previously Presented**) The method of Claim 78, wherein the upper circuit element comprises a memory cell capacitor and the lower circuit element comprises a substrate including an active area electrically connected to the conductive electrical connector.

Claim 84 (**Previously Presented**) A method of electrically connecting a capacitor having a high dielectric constant dielectric to a transistor active area, the method comprising:

forming a first barrier to corrosion covering sidewalls of a contact hole, wherein the first barrier comprises insulating material;

forming a second barrier to corrosion covering the first barrier and other surfaces of the contact hole, wherein the second barrier comprises a conductive material; and

forming a conductive contact plug which electrically connects the capacitor including a high dielectric constant dielectric to the transistor active area of a lower circuit element, wherein the second barrier is around the conductive contact plug and the first barrier is around the second barrier, thereby forming an electrical contact including at least two protective barriers around the conductive contact plug to avoid corrosive aspects associated with the fabrication of the capacitor.

Claim 85 (**Previously Presented**) The method of Claim 84, further comprising forming a third barrier to corrosion covering a side of the conductive contact plug opposite the transistor active area, wherein the third barrier comprises a conductive material and electrically connects the capacitor with the contact conductive contact plug.

Claim 86 (**Previously Presented**) The method of Claim 84, further comprising forming a third barrier to covering a side of the conductive contact plug nearest the transistor active area, wherein the third barrier comprises a conductive material and electrically connects the transistor active area with the contact conductive contact plug.

Claim 87 (**Previously Presented**) The method of Claim 84, further comprising:

forming a third barrier to corrosion covering a side of the conductive contact plug opposite the transistor active area, wherein the third barrier comprises a conductive material and electrically connects the capacitor with the contact conductive contact plug; and

forming a fourth barrier to covering a side of the conductive contact plug nearest the transistor active area, wherein the fourth barrier comprises a conductive material and electrically connects the transistor active area with the contact conductive contact plug.

Claim 88 (**Previously Presented**) The method of Claim 84, further comprising forming an insulating layer including a sidewall portion and a cap portion surrounding at least one of a bit line or a word line on the lower circuit element.

Claim 89 (**Previously Presented**) The method of Claim 88, wherein portions of the at least one of a bit line or a word line contact the first barrier.

APPENDIX B

This Appendix B contains a copy of each of the references discussed in this Appeal.

1. WIPO Publication WO 98/15013 to Hartner et al., published April 9, 1998, for *Semiconductor Device with a Protected Barrier for a Stack Cell*.
2. U.S. Patent No. 6,043,529 to Hartner et al., issued on March 28, 2000, for *Semiconductor Configuration with a Protected Barrier for a Stacked Cell*, which the Examiner considers as the English translation of WO 98/15013.
3. U.S. Patent No. 4,926,237 to Sun et al., issued on May 15, 1990, for *Device Metallization, Device and Method*.
4. U.S. Patent No. 5,346,844 to Cho et al., issued on September 13, 1994, for *Method for Fabricating Semiconductor Memory Device*.

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(51) Internationale Patentklassifikation 6 :
H01L 29/92, 21/3205

A1

(11) Internationale Veröffentlichungsnummer: **WO 98/15013**

(43) Internationales Veröffentlichungsdatum: 9. April 1998 (09.04.98)

(21) Internationales Aktenzeichen: PCT/DE97/02133

(22) Internationales Anmeldedatum: 19. September 1997 (19.09.97)

(30) Prioritätsdaten:
196 40 246.8 30. September 1996 (30.09.96) DE

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(81) Bestimmungsstaaten: CN, JP, KR, US, europäisches Patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

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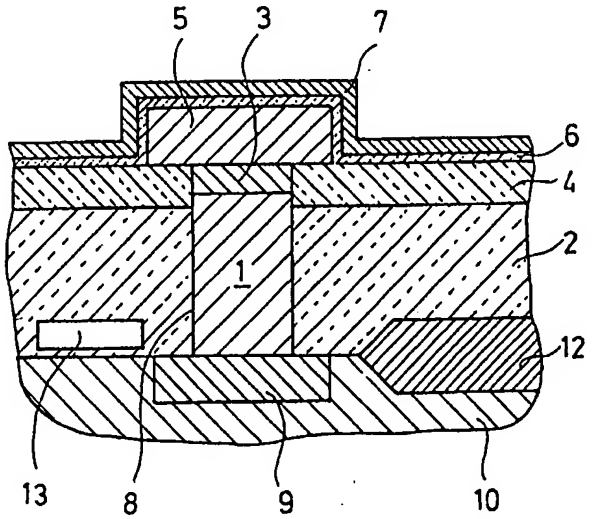
Mit internationalem Recherchenbericht.
Vor Ablauf der für Änderungen der Ansprüche zugelassenen Frist. Veröffentlichung wird wiederholt falls Änderungen eintreffen.

(54) Title: SEMICONDUCTOR DEVICE WITH A PROTECTED BARRIER FOR A STACK CELL

(54) Bezeichnung: HALBLEITERANORDNUNG MIT GESCHÜTZTER BARRIERE FÜR EINE STAPELZELLE

(57) Abstract

The invention relates to a semiconductor device for integrated circuits with a stack cell located in an insulating layer (2) having a plug (1) filled contact hole (8) with a capacitor with a lower electrode (5) turned towards the plug (1), a paraelectric or ferroelectric dielectric (6) and an upper electrode (7). A barrier layer (3) is located between the plug (1) and the lower electrode (5). Said layer is surrounded by a silicon nitride collar (4) preventing effective oxidation of barrier layer (3).



(57) Zusammenfassung

Die Erfindung betrifft eine Halbleiteranordnung für integrierte Schaltungen, bei der eine Stapelzelle in einer Isolierschicht (2) ein mit einem Plug (1) gefülltes Kontaktloch (8) aufweist, auf dem ein Kondensator mit einer unteren, dem Plug (1) zugewandten Elektrode (5), einem paraelektrischen oder ferroelektrischen Dielektrikum (6) und einer oberen Elektrode (7) vorgesehen ist. Zwischen dem Plug (1) und der unteren Elektrode (5) befindet sich eine Barriereschicht (3), die von einem Siliziumnitridkragen (4) umgeben ist, der eine Oxidation der Barriereschicht (3) zuverlässig verhindert.

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Beschreibung

Halbleiteranordnung mit geschützter Barriere für eine Stapelzelle

Die vorliegende Erfindung betrifft eine Halbleiteranordnung nach dem Oberbegriff des Patentanspruchs 1 sowie ein Verfahren zum Herstellen einer derartigen Halbleiteranordnung.

Herkömmliche Speicherelemente von Halbleiter-Speicheranordnungen verwenden als Speicherdielektrikum zumeist Siliziumdioxid- oder auch Siliziumnitridschichten, welche aber beide lediglich eine Dielektrizitätskonstante im Bereich von etwa 6 besitzen. Eine höhere Dielektrizitätskonstante würde jedoch zu einer größeren Kapazität des entsprechenden Kondensators führen, so daß auch dessen Abmessungen vermindert werden könnten, wenn auf eine entsprechende Steigerung der Kapazität verzichtet wird. Mit anderen Worten, die Verwendung eines Dielektrikums mit großer Dielektrizitätskonstante führt zu einer Verringerung der für den entsprechenden Kondensator benötigten Fläche und damit zu einer Steigerung der Integrationsdichte.

Die in diesem Zusammenhang durchgeführten Entwicklungen haben Materialien ergeben, die eine gegenüber 6 erheblich höhere Dielektrizitätskonstante aufweisen. So wurde beispielsweise als paraelektrisches Material $(Ba_xST_{1-x})TiO_3$ (BST) entwickelt, das eine Dielektrizitätskonstante in der Größenordnung von 400 hat. Es liegt auf der Hand, daß BST eine erhebliche Steigerung der Integrationsdichte erlaubt, wenn es anstelle der üblichen Siliziumdioxid- bzw. Siliziumnitridschichten eingesetzt wird.

Weiterhin verwenden herkömmliche Speicherelemente, wie beispielsweise ein dynamischer Random-Speicher (DRAM) paraelektrische Materialien, die aber bei Ausfall der Versorgungs-

spannung ihre Ladung und somit auch die mit dieser gespeicherte Information verlieren. Außerdem müssen derartige herkömmliche Speicherelemente wegen des bei ihnen auftretenden Leckstromes ständig neu beschrieben werden, was als "refreshen" bezeichnet wird. Auch aus diesem Grund ist der Einsatz von neuartigen ferroelektrischen Materialien als Speicherdielektrikum wünschenswert, da nur so die Herstellung nichtflüchtiger Halbleiter-Speicheran-ordnungen möglich ist, die bei Ausfall der Versorgungsspannung nicht ihre Information verlieren und auch nicht ständig neu beschrieben werden müssen.

Zusammenfassend ergibt sich damit, daß bei Halbleiter-Speicheranordnungen der Einsatz ferroelektrischer Materialien als Speicherdielektrikum an sich wünschenswert ist, da so eine Steigerung der Integrationsdichte bei gleichzeitiger Sicherheit gegenüber einem Ausfall der Versorgungsspannung erreicht werden kann.

Die praktische Verwirklichung des Einsatzes derartiger ferroelektrischer oder auch paraelektrischer Materialien in Halbleiter-Speicheranordnungen hängt aber stark davon ab, wie sich diese Materialien in eine integrierte Halbleiter-Schaltungsanordnung einbauen lassen. Als solche ferroelektrische oder paraelektrische Materialien wurden bisher neben dem bereits erwähnten BST auch $(Pb,Zr)TiO_3$(PZT), $SrBi_2Ta_2O_9$ (SBT), $SrBi_2(Ta,Nb)O_9$ (SBTN) $SrTiO_3$ (ST), ferro- und paraelektrische Polymere usw. bzw. allgemein ferro- und paraelektrische Materialien in Erwägung gezogen.

Obwohl diese Materialien hohe Dielektrizitätskonstanten aufweisen und aus diesem Grund auch schon bei ferroelektrischen Random-Speichern (FeRAM) eingesetzt werden, ist ihre Bedeutung in der Praxis noch begrenzt. Denn es hat sich gezeigt, daß die genannten Materialien mit hoher Dielektrizitätskonstante nicht ohne weiteres in Halbleiter-Speicheranordnungen eingesetzt werden können. So wird beispielsweise die Anwen-

dung von dielektrischen Materialien mit hoher Dielektrizitätskonstante oder von Ferroelektrika in hoch integrierten Stapelzellen von Halbleiter-Speicheranordnungen stark dadurch behindert, daß der sogenannte "Plug" bzw. das in ein Kontaktloch eingebrachte Füllmaterial bei Abscheidung des Dielektrikums oxidiert wird. Diese Oxidation findet speziell aufgrund der Tatsache statt, daß es sich bei den genannten Dielektrika mit hoher Dielektrizitätskonstanten und Ferroelektrika um Oxide handelt, die bei der Herstellung der Halbleiter- bzw. Kondensatoranordnung hohen Temperaturen in einer sauerstoffhaltigen Atmosphäre ausgesetzt werden müssen.

Da die üblicherweise für den Kondensatorkontakt verwendete Platin-Elektrode sauerstoffdurchlässig ist, oxidiert damit beispielsweise die Grenzfläche zwischen Plug und Elektrode, was mit einer elektrischen Unterbrechung gleichbedeutend ist.

Figur 3 zeigt eine derartige Halbleiteranordnung mit einer Speicherzelle. Bei dieser Halbleiteranordnung ist auf einen Halbleiterkörper 10 mit einem hochdotierten Bereich 9 eine di-
elektrische Isolatorschicht 2 aus z.B. Siliziumdioxid aufgebracht, in die ein Loch 8 geätzt ist. Dieses Loch 8 ist mit einem Füllmaterial bzw. Plug 1 gefüllt, der aus Wolfram oder polykristallinem Silizium besteht. Oberhalb des Plugs 1 ist eine Barriereschicht 3 vorgesehen, die beispielsweise aus WN, TiWN, TaN, WC usw. bestehen kann. Die Barriereschicht 3 trennt eine untere Elektrode 5 z.B. aus Platin von dem Plug 1. Auf der unteren Elektrode 5 befindet sich ein paraelektrisches oder ferroelektrische Dielektrikum 6, auf das wiederum eine obere Elektrode 7 aufgetragen ist. Bei dieser Halbleiteranordnung tritt beginnend im Bereich 11 eine Oxidation des Materials der Barriereschicht 3 auf, was letztlich zu einer elektrischen Unterbrechung führen kann. Die Oxidation schreitet dabei vom Bereich 11 entlang der Grenzfläche 14 zwischen der Barriereschicht 3 und der Elektrode 5 und entlang der

Grenzfläche 15 zwischen der Barriereschicht 3 und der Isolationsschicht 2 fort.

Nicht zuletzt aus diesem Grund wird bisher in der Praxis die Integration eines ferroelektrischen oder paraelektrischen Dielektrikums in einer Speicheranordnung bei hoher Integrationsdichte als wenig Erfolg versprechend angesehen.

Um die oben erwähnte Oxidation der Schnittfläche zwischen Elektrode und Plug in großem Umfang zu vermeiden, werden bisher Di-
elektrika mit hoher Dielektritzitätskonstanten oder Ferroelektrika erst nach Fertigstellung einer herkömmlichen CMOS-Transistorstruktur über einem LOCOS-Gebiet planar abgeschieden. Mit anderen Worten, neben einem MOS-Transistor, dessen Drain beispielsweise mit einer Bitleitung verbunden und dessen Gate an eine Wortleitung angeschlossen ist, wird über dem LOCOS-Gebiet ein Kondensator vorgesehen, dessen obere Elektrode aus z.B. Platin besteht, das mit der Source-Elektrode eines MOS-Transistors verbunden ist, und dessen Isolierschicht aus einem Ferroelektrikum hergestellt ist, während die zweite Elektrode (common plate), die der ersten Elektrode durch das Ferroelektrikum gegenüberliegt, ebenfalls aus z.B. Platin hergestellt ist. Als Dielektrikum kann hierbei beispielsweise SBT verwendet werden. Die Größen der auf diese Weise gebildeten Speicherzellen betragen beispielsweise 10,1 µm x 16,5 µm = 167 μm^2 = 46 F^2, wenn für F ein Grundmaß von 1,9 µm herangezogen wird. Die Fläche des Kondensators beträgt dabei etwa 3,3 µm x 3,3 µm = 10,9 μm^2 = 3 F^2. Mit anderen Worten, es liegt ein relativ großer Platzbedarf für die Speicherzelle bzw. deren Verdrahtung zum Kondensator vor.

Vorteilhaft am Auftragen eines Kondensators über dem LOCOS-Ge-biet ist aber, daß zur Herstellung der planaren ferroelektrischen Schicht des Kondensators ein Sputter- oder Solgel-Ver-fahren benutzt werden kann und insbesondere durch das Aufbringen der ferroelektrischen Schicht, das in stark oxi-

dierender Umgebung stattfindet, die Diffusion von Sauerstoff durch die meist aus Platin bestehende Elektrode hindurch die darunter liegende Schicht nicht mehr beeinträchtigt, da hier bereits ein Oxid vorliegt.

Zusammenfassend ergibt sich damit, daß das Abscheiden einer CMOS-Transistorstruktur über dem LOCOS-Gebiet zwar ohne weiters möglich ist, jedoch zu einer erheblichen Verminderung der Integrationsdichte führt.

Ein direktes Auftragen der ferroelektrischen Schichten über dem elektrisch leitenden Plug ist zwar möglich, führt aber zu einer weiteren Oxidation und damit letztlich zu einer Isolation der elektrischen Verbindungen.

Es ist daher **A u f g a b e** der vorliegenden Erfindung, eine Halbleiteranordnung zu schaffen, die eine Integration von Bauelementen mit ferroelektrischen und paraelektrischen Materialien erlaubt und bei der unerwünschte Oxidationen im Bereich der Barriereschicht des Plugs zuverlässig vermieden sind; außerdem soll ein Verfahren zum Herstellen einer derartigen Halbleiteranordnung angegeben werden.

Zur Lösung dieser Aufgabe sieht die vorliegende Erfindung eine Halbleiteranordnung mit den Merkmalen des Patentanspruches 1 vor. Außerdem wird ein Verfahren mit den Merkmalen des Patentanspruches 5 geschaffen.

Vorteilhafte Weiterbildungen der Erfindung ergeben sich insbesondere aus den Patentansprüchen 2 bis 4.

Bei der erfindungsgemäßen Halbleiteranordnung ist also die Barriereschicht in einen "Siliziumnitridkragen", der durch die Siliziumnitridschicht gebildet ist, eingebettet. Dadurch wird das Material der Barriereschicht, also beispielsweise Tiannitrid, Wolframnitrid, Titanwolframnitrid, Tantalnitrid usw., vor einer Oxidation zuverlässig geschützt.

Durch den "Siliziumnitridkragen" wird eine laterale Sauerstoff-Diffusion bei der Herstellung des paraelektrischen oder ferroelektrischen Dielektrikums vermieden. Das heißt, es tritt praktisch keine laterale Oxidation der Barriereschicht auf, wie dies beim Stand der Technik der Fall ist. Außerdem wird erreicht, daß das Material, z.B. Platin, der unteren Elektrode gut auf der Siliziumnitridschicht haftet.

Nachfolgend wird die Erfindung anhand der Zeichnungen näher erläutert. Es zeigen:

Fig. 1 einen Schnitt durch ein erstes Ausführungsbeispiel der erfindungsgemäße Halbleiteranordnung;

Fig. 2 einen Schnitt durch ein zweites Ausführungsbeispiel der erfindungsgemäßen Halbleiteranordnung

und

Fig. 3 einen Schnitt durch eine bestehende Halbleiteranordnung.

In den Figuren sind einander entsprechende Bauteile jeweils mit den gleichen Bezugszeichen versehen.

Wie in einem ersten Ausführungsbeispiel in Fig. 1 gezeigt ist, befindet sich bei der erfindungsgemäßen Halbleiteranordnung auf einem Siliziumsubstrat 10 mit einem hochdotierten Bereich 9 eine Siliziumdioxidschicht 2, die ein Kontaktloch 8 zu dem hochdotierten Bereich 9 aufweist. In der Siliziumdioxidschicht 2 bzw. auf dem Siliziumsubstrat 10 können noch weitere leitende oder hochdotierte Bereiche 13 und Isolati-

onsbereiche 12 vorgesehen sein. Diese hochdotierten Bereiche 13, 12 können beispielsweise Leiterbahnen oder LOCOS sein.

Das Kontaktloch 8 ist mit Füllmaterial bzw. Plug 1 versehen. Zwischen dem Plug 1, dessen leitendes Material aus z.B. Wolfram, Silizium, Nitriden oder polykristallinem Silizium besteht, und einer unteren Elektrode 5 aus z.B. Platin ist eine Barriereschicht 3 angeordnet, die aus leitenden Nitriden, Karbiden, Boriden usw., wie z.B. WN, WC, WTiN, TaN, TiN, TiC usw. hergestellt sein kann. Ein mögliches Material für den Plug 1 ist beispielsweise WSi. Die Barriereschicht 3 wird seitlich von einer Siliziumnitridschicht 4 umgeben, deren Oberseite in der gleichen Ebene wie die Oberseite der Barriereschicht 3 liegt. Die Oberseite der Barriereschicht 3 kann aber auch etwas unterhalb der Oberseite der Siliziumnitridschicht 4 liegen. Auf die untere Elektrode 5 aus Platin ist ein paraelektrisches, superparaelektrisches oder ferroelektrisches Dielektrikum 6 aufgetragen, welches wiederum mit einer oberen Elektrode 7 bedeckt ist. Die obere Elektrode 7 und/oder die untere Elektrode 5 können auch aus Ruthenium, Iridium, Palladium oder leitenden Oxiden hiervon, wie RuO_2, IrO_2 usw. bestehen.

Die Herstellung der erfindungsgemäßen Halbleiteranordnung kann beispielsweise in der folgenden Weise geschehen:

Zunächst wird die CMOS-Ebene mit dem Halbleiterkörper 10, den hochdotierten Bereichen 9 und 13, dem Isolationsbereich 12 und der Siliziumdioxidschicht 2 hergestellt. Vor Ätzung des Kontaktloches 8 wird sodann die Siliziumnitridschicht 4 abgeschieden.

Nach Ätzung des Kontaktloches 8 und Auffüllung des Kontaktloches 8 mit Wolfram, leitendem Material, wie Siliziden oder polykristallinem Silizium erfolgt eine Rückätzung zur Bildung einer Aussparung im oberen Bereich des Plugs 1. Die Tiefe dieser Rückätzung ist etwa an die Dicke der Siliziumnitrid-

schicht so angepaßt, daß sie etwas kleiner als die Dicke der Siliziumnitridschicht 4 ist. Sodann wird durch Sputtern oder MOCVD die Barriereschicht 3 im Bereich der Rückätzung aufgebracht. Durch beispielsweise einen Rückätz- oder Schleifprozeß wird die Oberfläche der Barriereschicht 3 mit der Oberfläche der Siliziumnitridschicht 4 ausgerichtet. Mit anderen Worten, die Siliziumnitridschicht 4 umgibt wie ein "Kragen" die Barriereschicht 3.

Auf die Barriereschicht 3 wird die untere Elektrode 5, die bevorzugt aus Platin besteht, aufgetragen. Sodann wird das paraelektrische, superparaelektrische oder ferroelektrische Dielektrikum 6 aufgebracht und strukturiert. Die Barriereschicht 3 wirkt während des Abscheidens des Dielektrikums 6 sowie bei den nachfolgenden oxidierenden Temperaturprozessen als Schutz gegen eindiffundierenden Sauerstoff und verhindert die Oxidation des Plugs 1. Die Siliziumnitridschicht 4 schützt dabei die eingebettete Barriereschicht 3 zuverlässig vor der Oxidation und gewährleistet die Integrität der Platin/Barriereschicht/Plug/ Struktur. Siliziumnitrid ist bekanntlich eine gute Sauerstoff-Diffusionsbarriere, die die Zufuhr von Sauerstoff im vorliegenden Fall zum Übergangsbereich zwischen Barriereschicht und unterer Elektrode aus der Umgebung verhindert.

Die vorliegende Erfindung erhöht damit den Oxidationswiderstand der Barriereschicht 3 in großem Ausmaß.

Fig. 2 zeigt ein weiteres Ausführungsbeispiel der Erfindung. Bei diesem Ausführungsbeispiel ist die Wand des Kontaktloches 8 mit einer Zusatz-Siliziumnitridschicht 16 bedeckt, die nach der Ätzung des Kontaktloches 8 abgeschieden wird.

PATENTANSPRÜCHE

1. Halbleiteranordnung für integrierte Schaltungen, insbesondere Speicher, in DRAM- und FeRAM-Technik, bei der eine Stapelzelle in einer Isolierschicht (2) ein mit einem Füllmaterial bzw. Plug (1) gefülltes Kontaktloch (8) aufweist, auf dem ein Kondensator mit einer unteren, dem Füllmaterial (1) zugewandten Elektrode (5), einem superparaelektrischen oder paraelektrischen oder ferroelektrischen Dielektrikum (6) und einer oberen Elektrode (7) vorgesehen ist, wobei zwischen dem Füllmaterial (1) und der unteren Elektrode (5) eine Barriereschicht (3) vorgesehen ist, die von Bereichen aus Siliziumnitrid vollständig umgeben ist,

d a d u r c h g e k e n n z e i c h n e t ,

daß die Barriereschicht (3) in dem Kontaktloch (8) auf dem Füllmaterial (1) angeordnet ist,

daß die Bereiche aus Siliziumnitrid von einer auf der Isolierschicht (2) angeordneten Siliziumnitridschicht (4) gebildet sind,

daß die Siliziumnitridschicht (4) an das Kontaktloch (8) angrenzt, und

daß auf einer von der Barriereschicht (3) und der Siliziumnitridschicht (4) gebildeten Ebene die untere Elektrode (5), das Dielektrikum (6) und die obere Elektrode (7) angeordnet sind.

2. Halbleiteranordnung nach Anspruch 1,
dadurch gekennzeichnet,
daß das Füllmaterial aus leitenden Materialien, insbesondere aus Siliziden, Nitriden, Wolfram oder polykristallinem Silizium besteht.

3. Halbleiteranordnung nach Anspruch 1 oder 2,
dadurch gekennzeichnet,
daß die untere Elektrode (5) und/oder die obere Elektrode (7) aus Platin, Ruthenium, Iridium, Palladium oder leitenden Oxiden hiervon bestehen.

4. Halbleiteranordnung nach einem der Ansprüche 1 bis 3,
dadurch gekennzeichnet,
daß die Barriereschicht (3) aus WN, WC, WTiN, TaN, TiN oder TiC besteht.

5. Verfahren zur Herstellung der Halbleiteranordnung nach einem der Ansprüche 1 bis 4,
dadurch gekennzeichnet,
daß nach Herstellung einer CMOS-Ebene mit einem Halbleiterkörper (10) auf diesem eine Isolierschicht (2) erzeugt und eine Siliziumnitridschicht (4) aufgetragen wird,
daß in die Siliziumnitridschicht (4) und die Isolierschicht (2) ein Kontaktloch (8) eingebracht wird,

daß das Kontaktloch (8) mit leitendem Füllmaterial (1), insbesondere aus Siliziden, Nitriden, Wolfram oder polykristallinem Silizium, aufgefüllt wird,

daß in dem Füllmaterial (1) eine Aussparung erzeugt wird, die eine an die Dicke der Siliziumnitridschicht (4) angepaßte Tiefe hat,

daß in der Aussparung eine Barriereschicht (3) erzeugt wird,

daß die Barriereschicht (3) durch einen Schleif- oder Rückätzprozeß in die Siliziumnitridschicht (4) eingebettet wird, und

daß nacheinander die untere Elektrode (5), das Dielektrikum (6) und die obere Elektrode (7) aufgebracht werden.

6. Verfahren nach Anspruch 5,

d a d u r c h g e k e n n z e i c h n e t ,

daß nach Ätzung des Kontaktloches (8) auf dessen Wand eine Siliziumnitridschicht (16) abgeschieden wird.

Fig. 1

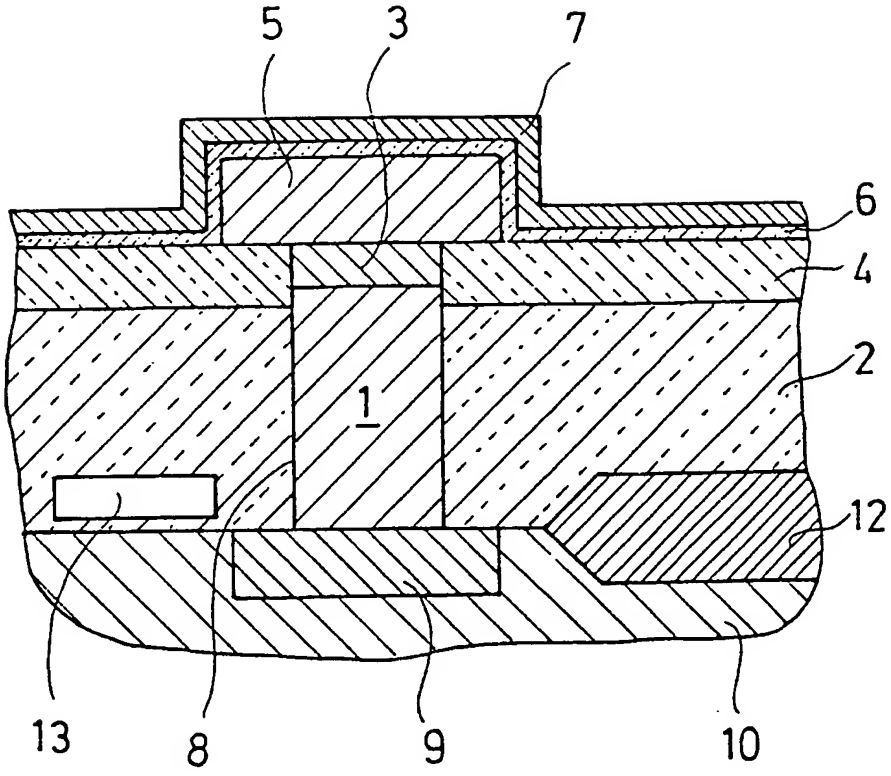


Fig. 2

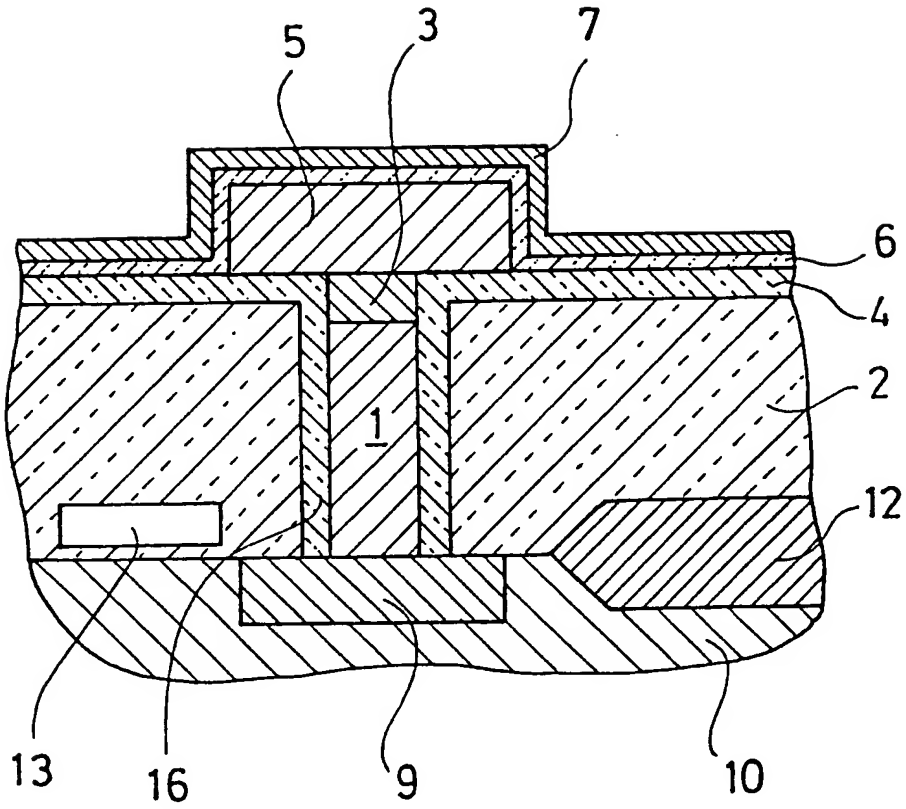
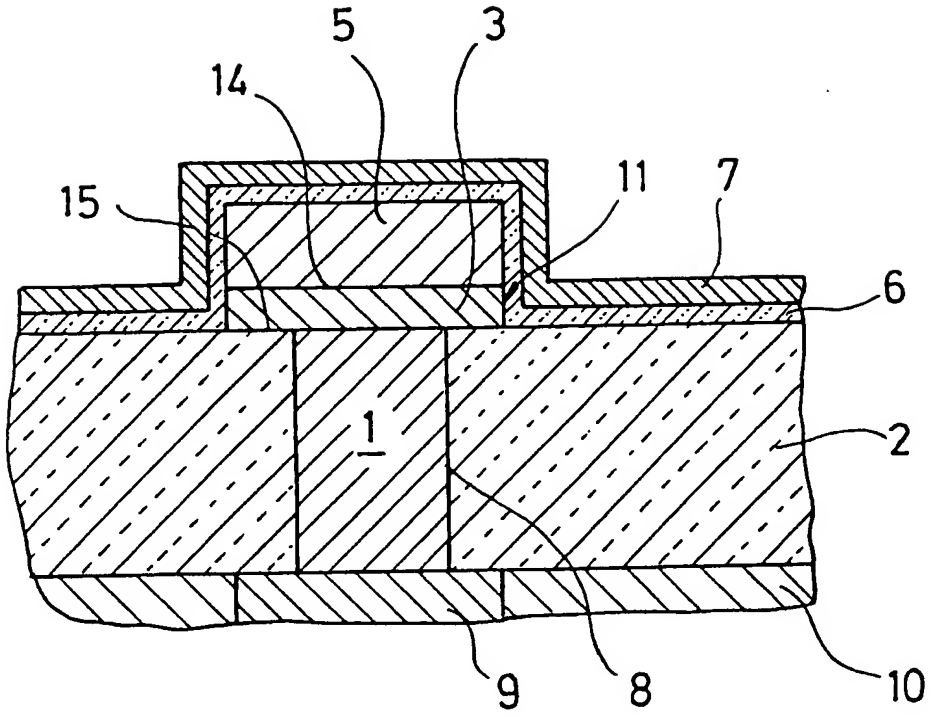


Fig. 3



INTERNATIONAL SEARCH REPORT

International Application No
PCT/DE 97/02133

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01L29/92 H01L21/3205

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 506 166 A (SANDHU GURTEJ S ET AL) 9 April 1996	1-5
A	see column 3, line 64 - column 7, line 20; figures 2-13B	6
X	EP 0 697 719 A (TEXAS INSTRUMENTS INC) 21 February 1996	1-5
A	see page 2, line 25 - page 3, line 35; table KOMPLET see page 5, line 42 - line 46; figures 1,2 see page 7, line 3 - page 14, line 10; figures 10-17	6

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 January 1998	27/01/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Albrecht, C

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/DE 97/02133

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5506166 A	09-04-96	US 5381302 A	10-01-95
		US 5392189 A	21-02-95
		US 5478772 A	26-12-95
EP 0697719 A	21-02-96	US 5504041 A	02-04-96
		JP 8064786 A	08-03-96
		US 5679980 A	21-10-97

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/DE 97/02133

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 6 H01L29/92 H01L21/3205

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 6 H01L

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
X A	US 5 506 166 A (SANDHU GURTEJ S ET AL) 9.April 1996 siehe Spalte 3, Zeile 64 - Spalte 7, Zeile 20; Abbildungen 2-13B	1-5 6
X A	EP 0 697 719 A (TEXAS INSTRUMENTS INC) 21.Februar 1996 siehe Seite 2, Zeile 25 - Seite 3, Zeile 35; Tabelle KOMPLET siehe Seite 5, Zeile 42 - Zeile 46; Abbildungen 1,2 siehe Seite 7, Zeile 3 - Seite 14, Zeile 10; Abbildungen 10-17	1-5 6

☐ Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

☒ Siehe Anhang Patentfamilie

° Besondere Kategorien von angegebenen Veröffentlichungen :
"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist
"E" älteres Dokument, das jedoch erst am oder nach dem internationalen Anmeldedatum veröffentlicht worden ist
"L" Veröffentlichung, die geeignet ist, einen Prioritätsanspruch zweifelhaft erscheinen zu lassen, oder durch die das Veröffentlichungsdatum einer anderen im Recherchenbericht genannten Veröffentlichung belegt werden soll oder die aus einem anderen besonderen Grund angegeben ist (wie ausgeführt)
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"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann allein aufgrund dieser Veröffentlichung nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden
"Y" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann nicht als auf erfinderischer Tätigkeit beruhend betrachtet werden, wenn die Veröffentlichung mit einer oder mehreren anderen Veröffentlichungen dieser Kategorie in Verbindung gebracht wird und diese Verbindung für einen Fachmann nahelegend ist
"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
16.Januar 1998	27/01/1998

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Albrecht, C

Formblatt PCT/ISA/210 (Blatt 2) (Juli 1992)

INTERNATIONALER RECHERCHENBERICHT

Angaben zu Veröffentlichungen, die zur selben Patentfamilie gehören

Internationales Aktenzeichen
PCT/DE 97/02133

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
US 5506166 A	09-04-96	US 5381302 A	10-01-95
		US 5392189 A	21-02-95
		US 5478772 A	26-12-95
EP 0697719 A	21-02-96	US 5504041 A	02-04-96
		JP 8064786 A	08-03-96
		US 5679980 A	21-10-97

APPENDIX C

This Appendix C contains a copy of each of the Federal Circuit cases discussed in this Appeal.

1. *In re Dembiczak*, 175 F.3d 994, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999).
2. *In re Kotzab*, 217 F.3d 1365, 55 U.S.P.Q.2d 1313 (Fed. Cir. 2000).
3. *In re Gartside*, 203 F.3d 1305, 53 U.S.P.Q.2d 1769 (Fed. Cir. 2000).
4. *In re Lee*, 277 F.3d 1338, 61 U.S.P.Q.2d 1430 (Fed. Cir. 2002).

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052604

In re Anita DEMBICZAK and Benson Zinbarg, Appellants.

No. 98-1498.

United States Court of Appeals, Federal Circuit.

April 28, 1999.

Board of Patent Appeals and Interferences upheld rejection of application for utility patent, and appeal was taken. The United States Court of Appeals for the Federal Circuit, Clevenger, Circuit Judge, held that: (1) Board erred by rejecting application for patent on plastic trash bags with pumpkin face on grounds of obviousness, without finding suggestion, teaching, or motivation to combine prior art references, and (2) applicant's earlier design patents involving pumpkin faces on bags did not preclude issuance of patent in present case, under obviousness-type double patenting doctrine.

Reversed.

1. Patents ⇐113(6)

Federal Circuit determines legal question of obviousness of patent without deference to Board of Patent Appeals and Interferences, and examines any factual findings for clear error. 35 U.S.C.A. § 103(a).

3. The titles and abstracts are different, for example.

2. Patents ⇐16(1)

Measuring a claimed invention for obviousness requires the oft-difficult but critical step of casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. 35 U.S.C.A. § 103(a).

3. Patents ⇐16(4)

Best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis of a patent application is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references. 35 U.S.C.A. § 103(a).

4. Patents ⇐26(1)

Evidence of a suggestion, teaching, or motivation to combine prior art references, sufficient to render invention obvious and unpatentable, may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved. 35 U.S.C.A. § 103(a).

5. Patents ⇐36(1)

Broad conclusory statements regarding the teaching of multiple references, standing alone, are not evidence sufficient to render invention obvious and unpatentable. 35 U.S.C.A. § 103(a).

6. Patents ⇐16.27

Board of Patent Appeals and Interferences erred by denying for obviousness application for utility patent for orange colored plastic trash bag with markings, which expanded to show face of pumpkin when filled with leaves, when Board cited prior art showing placement of pumpkin faces on crepe paper and which disclosed features of plastic trash bags and concluded that prior art references collectively described all limitations of present claims; Board should have found a suggestion, teaching, or motivation to combine prior art references. 35 U.S.C.A. § 103(a).

7. Patents ⇐113(6)

Federal Circuit would not consider argument made in support of obviousness of patent application, which was not raised before Board of Patent Appeals and Interferences. 35 U.S.C.A. § 103(a).

8. Patents ⇐120

The doctrine of "obviousness-type double patenting" prohibits claims in a second patent which define merely an obvious variation of an invention claimed by the same inventor in an earlier patent. 35 U.S.C.A. § 103(a).

See publication Words and Phrases for other judicial constructions and definitions.

9. Patents ⇐314(5)

Question whether patent application is to be rejected, under obvious-type double patenting doctrine, on grounds that claimed invention was merely an obvious variation on invention disclosed in existing patent, is one of law, which Federal Circuit reviews de novo. 35 U.S.C.A. § 103(a).

10. Patents ⇐120

In some very rare cases, obvious-type double patenting, in which invention claimed in patent application was obvious variation on invention disclosed by existing patent, may be found between design and utility patents. 35 U.S.C.A. § 103(a).

11. Patents ⇐120

When utility patent is sought to be invalidated due to obviousness, in light of previous design patents, rejection under obviousness-type double patenting doctrine is appropriate only if the claims of the two patents cross-read, meaning that the test is whether the subject matter of the claims of the patent sought to be invalidated would have been obvious from the subject matter of the claims of the other patent, and vice versa. 35 U.S.C.A. § 103(a).

12. Patents ⇐28

In order for a design to be unpatentable because of obviousness, there must first be a basic design reference in the

prior art, the design characteristics of which are basically the same as the claimed design. 35 U.S.C.A. § 103(a).

13. Patents ⇐120

Phrase "having facial indicia thereon," contained in claim of application for utility patent on plastic trash bag with pumpkin face, was not design reference that was basically the same as claimed design covered by design patents on jack-o-lantern faces on bags, and application was consequently not required to be rejected under obviousness-type double patenting doctrine. 35 U.S.C.A. § 103(a).

David P. Gordon, of Stamford, Connecticut, argued for appellant. Of counsel was Thomas A. Gallagher, of Stamford, Connecticut.

John M. Whealan, Associate Solicitor, Office of the Solicitor, of Arlington, Virginia, argued for appellee. With him on the brief were Albin F. Drost, Acting Solicitor, and David R. Nicholson, Associate Solicitor.

Before MAYER, Chief Judge, MICHEL and CLEVENGER, Circuit Judges.

CLEVENGER, Circuit Judge.

Anita Dembiczak and Benson Zinbarg appeal the rejection, upheld by the Board of Patent Appeals and Interferences, of all pending claims in their Application No. 08/427,732. *See Ex Parte Dembiczak*, No. 96-2648, slip op. at 43 (May 14, 1998). Because the Board erred in sustaining rejections of the pending claims as obvious under 35 U.S.C. § 103(a) (Supp.1998), and for obviousness-type double patenting, we reverse.

I

The invention at issue in this case is, generally speaking, a large trash bag made of orange plastic and decorated with lines and facial features, allowing the bag, when filled with trash or leaves, to resemble a Halloween-style pumpkin, or jack-o'-lantern. As the inventors, Anita Dembiczak and Benson Zinbarg (collectively, "Dembiczak") note, the invention solves the long-standing problem of unsightly trash bags placed on the curbs of America, and, by fortuitous happenstance, allows users to express their whimsical or festive nature while properly storing garbage, leaves, or other household debris awaiting collection. Embodiments of the invention—sold under a variety of names, including Giant Stuff-A-Pumpkin, Funkins, Jack Sak, and Bag-O-Fun—have undisputedly been well-received by consumers, who bought more than seven million units in 1990 alone. Indeed, in 1990, the popularity of the pumpkin bags engendered a rash of thefts around Houston, Texas, leading some owners to resort to preventative measures, such as greasing the bags with petroleum jelly and tying them to trees. *See* R. Piller, "Halloween Hopes Die on the Vine," *Hous. Chron.*, Oct. 19, 1990, at 13A.

The road to profits has proved much easier than the path to patentability, however. In July 1989, Dembiczak filed a utility patent application generally directed to the pumpkin bags. In a February 1992 appeal, the Board of Patent Appeals and Interferences ("the Board") reversed the Examiner's rejection, but entered new grounds for rejection. Dembiczak elected to continue prosecution, filing a continuation application to address the new grounds for rejection. Thereafter, the invention made a second appearance before the Board, in April 1993, when the Board both sustained the Examiner's rejection and again entered new grounds for rejection. Again, a continuation application was filed (the instant application). And again the Examiner's rejection was appealed to the Board, which sustained the rejection in a May 14, 1998, decision. *See Dembiczak*, slip op. at 43.

A

The patent application at issue includes claims directed to various embodiments of

the pumpkin bag. Claims 37, 49, 51, 52, 58 through 64, 66 through 69, and 72 through 81 are at issue in this appeal. Though the claims vary, independent claim 74 is perhaps most representative:

> 74. A decorative bag for use by a user with trash filling material, the bag simulating the general outer appearance of an outer surface of a pumpkin having facial indicia thereon, comprising:
>
> a flexible waterproof plastic trash or leaf bag having
>
> an outer surface which is premanufactured orange in color for the user to simulate the general appearance of the outer skin of a pumpkin, and having
>
> facial indicia including at least two of an eye, a nose and a mouth on the orange color outer surface for forming a face pattern on said orange color outer surface to simulate the general outer appearance of a decorative pumpkin with a face thereon,
>
> said trash or leaf bag having first and second opposite ends, at least said second end having an opening extending substantially across the full width of said trash or leaf bag for receiving the trash filling material,
>
> wherein when said trash or leaf bag is filled with trash filling material and closed, said trash or leaf bag takes the form and general appearance of a pumpkin with a face thereon.

All of the independent claims on appeal, namely 37, 52, 72, and 74, contain limitations that the bag must be "premanufactured orange in color," have "facial indicia," have openings suitable for filling with trash material, and that when filled, the bag must have a generally rounded appearance, like a pumpkin. Independent claims 37, 52, and 72 add the limitation that the bag's height must at least 86 inches. Claim 72 requires that the bag be made of a "weatherproof material," and claim 74, as shown above, requires that the bag be "waterproof." Claim 52 recites a "method of assembling" a bag with the general characteristics of apparatus claim 37.

B

The prior art cited by the Board includes:

(1) pages 24–25 of a book entitled "A Handbook for Teachers of Elementary Art," by Holiday Art Activities ("Holiday"), describing how to teach children to make a "Crepe Paper Jack-O-Lantern" out of a strip of orange crepe paper, construction paper cut-outs in the shape of facial features, and "wadded newspapers" as filling;

(2) page 73 of a book entitled "The Everything Book for Teachers of Young Children," by Martha Shapiro and Valerie Indenbaum ("Shapiro"), describing a method of making a "paper bag pumpkin" by stuffing a bag with newspapers, painting it orange, and then painting on facial features with black paint;

(3) U.S. Patent No. 3,349,991 to Leonard Kessler, entitled "Flexible Container" ("Kessler"), describing a bag apparatus wherein the bag closure is accomplished by the use of folds or gussets in the bag material;

(4) U.S. Patent No. Des. 310,023, issued August 21, 1990 to Dembiczak ("Dembiczak '023"), a design patent depicting a bag with a jack-o'-lantern face;

(5) U.S. Patent No. Des. 317,254, issued June 4, 1991 to Dembiczak ("Dembiczak '254"), a design patent depicting a bag with a jack-o'-lantern face; and,

(6) Prior art "conventional" plastic lawn or trash bags ("the conventional trash bags").

Using this art, the Board affirmed the Examiner's final rejection of all the independent claims (37, 52, 72, 74)

U.S.C. § 103, holding that they would have been obvious in light of the conventional trash bags in view of the Holiday and Shapiro references. The Board determined that, in its view of the prior art, "the only difference between the invention presently defined in the independent claims on appeal and the orange plastic trash bags of the prior art and the use of such bags resides in the application of the facial indicia to the outer surface of the bag." *Dembiczak*, slip op. at 18. The Board further held that the missing facial indicia elements were provided by the Holiday and Shapiro references' description of painting jack-o'-lantern faces on paper bags. *See id.* at 18–19. Dependent claims 49 and 79, which include a "gussets" limitation, were considered obvious under similar reasoning, except that the references cited against them included Kessler. *See id.* at 7.

The Board also affirmed the Examiner's obviousness-type double patenting rejection of all the independent claims in light of the two Dembiczak design patents ('023 and '254) and Holiday. *See id.* at 12. The Board held that the design patents depict a generally rounded bag with jack-o'-lantern facial indicia, and that the Holiday reference supplies the missing limitations, such as the "thin, flexible material" of manufacture, the orange color, the initially-open upper end, and the trash filling material. The Board also stated that the various limitations of the dependent claims—*e.g.*, color, the inclusion of leaves as stuffing, and the dimensions—would all be obvious variations of the depictions in the Dembiczak design patents. *See id.* at 8–9. In addition, using a two-way test for obviousness-type double patenting, the Board held that the claims of the Dembiczak design patents "do not exclude" the additional structural limitations of the pending utility claims, and thus the design patents were merely obvious variations of the subject matter disclosed in the utility claims. *See id.* at 11. The Board further upheld, on similar grounds and with the inclusion of the Kessler reference, the obviousness-type double patenting rejection of dependent claim 49. *See id.* at 12.

This appeal followed, vesting this court with jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A) (1994).

II

[1] A claimed invention is unpatentable if the differences between it and the prior art "are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103(a) (Supp.1998); *see Graham v. John Deere Co.*, 383 U.S. 1, 14, 86 S.Ct. 684, 15 L.Ed.2d 545, 148 USPQ 459, 465 (1966). The ultimate determination of whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the prior art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness. *See Graham*, 383 U.S. at 17–18, 86 S.Ct. 684, 15 L.Ed.2d 545, 148 USPQ at 467; *Miles Labs., Inc. v. Shandon Inc.*, 997 F.2d 870, 877, 27 USPQ2d 1123, 1128 (Fed.Cir.1993). We therefore review the ultimate determination of obviousness without deference to the Board, while examining any factual findings for clear error. *See*, e.g., *In re Zurko*, 142 F.3d 1447, 1459, 46 USPQ2d 1691, 1700 (Fed.Cir.) (en banc), cert. granted, — U.S. ——, 119 S.Ct. 401, 142 L.Ed.2d 326 (1998).

A

[2] Our analysis begins in the text of section 103 quoted above, with the phrase "at the time the invention was made." For it is this phrase that guards against entry into the "tempting but forbidden zone of hindsight," *see Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 873, 228 USPQ 90, 98 (Fed.Cir.1985), overruled on other grounds by *Nobelpharma AB v. Implant Innovations, Inc.*, 141 F.3d 1059, 46 USPQ2d

1097 (Fed.Cir.1998), when analyzing the patentability of claims pursuant to that section. Measuring a claimed invention against the standard established by section 103 requires the oft-difficult but critical step of casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. *See, e.g., W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 313 (Fed.Cir.1983). Close adherence to this methodology is especially important in the case of less technologically complex inventions, where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher." *Id.*

[3] Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references. *See, e.g., C.R. Bard, Inc. v. M3 Sys., Inc.*, 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed.Cir.1998) (describing "teaching or suggestion or motivation [to combine]" as an "essential evidentiary component of an obviousness holding"); *In re Rouffet*, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed.Cir.1998) ("the Board must identify specifically ... the reasons one of ordinary skill in the art would have been motivated to select the references and combine them"); *In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed.Cir.1992) (examiner can satisfy burden of obviousness in light of combination "only by showing some objective teaching [leading to the combination]"); *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed.Cir.1988) (evidence of teaching or suggestion "essential" to avoid hindsight); *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297, 227 USPQ 657, 667 (Fed. Cir.1985) (district court's conclusion of obviousness was error when it "did not elucidate any factual teachings, suggestions or incentives from this prior art that showed the propriety of combination"). *See also Graham*, 383 U.S. at 18, 86 S.Ct. 684, 15 L.Ed.2d 545, 148 USPQ at 467 ("strict observance" of factual predicates to obviousness conclusion required). Combining prior art references without evidence of such a suggestion, teaching, or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability—the essence of hindsight. *See, e.g., Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1138, 227 USPQ 543, 547 (Fed.Cir.1985) ("The invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time."). In this case, the Board fell into the hindsight trap.

[4, 5] We have noted that evidence of a suggestion, teaching, or motivation to combine may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved, *see Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed.Cir.1996); *Para-Ordnance Mfg. v. SGS Importers Intern., Inc.*, 73 F.3d 1085, 1088, 37 USPQ2d 1237, 1240 (Fed.Cir.1995), although "the suggestion more often comes from the teachings of the pertinent references." *Rouffet*, 149 F.3d at 1355, 47 USPQ2d at 1456. The range of sources available, however, does not diminish the requirement for actual evidence. That is, the showing must be clear and particular. *See, e.g., C.R. Bard*, 157 F.3d at 1352, 48 USPQ2d at 1232. Broad conclusory statements regarding the teaching of multiple references, standing alone, are not "evidence." *E.g., McElmurry v. Arkansas Power & Light Co.*, 995 F.2d 1576, 1578, 27 USPQ2d 1129, 1131 (Fed.Cir.1993) ("Mere denials and conclusory statements, however, are not sufficient to establish a genuine issue of

different from that relied upon by the Board, arguing that one of ordinary skill in the art would have been motivated to combine the references. Of course, in order to do so, the Commissioner must do what the Board did not do below: make specific findings of fact regarding the level of skill in the art ("a designer and manufacturer of trash and leaf bags, particularly one specializing in the ornamental and graphic design of such bags"), Resp't Br. at 14, the relationship between the fields of conventional trash bags and children's crafts, respectively ("[t]he artisan would also have been well aware of the ancillary, corollary, and atypical uses of 'trash' bags such as their application in hobby and art projects"), Resp't Br. at 15, and the particular features of the prior art references that would motivate one of ordinary skill in a particular art to select elements disclosed in references from a wholly different field ("a designer and manufacturer of trash and leaf bags would have recognized the paper bag in Shapiro to be a trash bag and therefore would have been motivated to combine it with the admitted prior art plastic trash and leaf bags to arrive at the claimed invention"), Resp't Br. at 15. The Commissioner also appears to cite additional references in support of his obviousness analysis, noting that at least two design patents (in the record but not cited against the presently pending claims) teach the placement of "graphical information, including text, designs, and even facial indicia, to colored bags." Resp't Br. at 16. This new analysis, apparently cut from whole cloth in view of appeal, does little more than highlight the shortcomings of the decision below, and we decline to consider it. *See, e.g., In re Robertson*, 169 F.3d 743, 746, 49 USPQ2d 1949, 1951 (Fed.Cir.1999) ("We decline to consider [the Commissioner's] newly-minted theory as an alternative ground for upholding the agency's decision."); *In re Soni*, 54 F.3d 746, 751, 34 USPQ2d 1684, 1688 (Fed.Cir. 1995); *In re Hounsfield*, 699 F.2d 1320, 1324, 216 USPQ 1045, 1049 (Fed.Cir.1983) (rejecting an "attempt[ ] by the Commissioner 'to apply a new rationale to support the rejection.' "); see also 35 U.S.C. § 144 (1994) (an appeal to the Federal Circuit "is taken on the record before The Patent and Trademark Office"). Because the Board has not established a prima facie case of obviousness, *see In re Bell*, 991 F.2d 781, 783, 26 USPQ2d 1529, 1531 (Fed.Cir.1993) ("The PTO bears the burden of establishing a case of prima facie obviousness."), we therefore reverse the obviousness rejections, and have no need to address the parties' arguments with respect to secondary factors.

III

[8, 9] Dembiczak also asks this court to reverse the Board's rejection of the pending claims for obviousness-type double patenting, which is a judicially-created doctrine that seeks to prevent the applicant from expanding the grant of the patent right beyond the limits prescribed in Title 35. *See, e.g., In re Braat*, 937 F.2d 589, 592, 19 USPQ2d 1289, 1291–92 (Fed.Cir. 1991); *In re Longi*, 759 F.2d 887, 892, 225 USPQ 645, 648 (Fed.Cir.1985). *See also* 35 U.S.C. § 154(a)(2) (Supp.1998) (discussing patent term). The doctrine prohibits claims in a second patent which define "merely an obvious variation" of an invention claimed by the same inventor in an earlier patent. *Braat*, 937 F.2d at 592, 19 USPQ2d at 1292 (quoting *In re Vogel*, 57 C.C.P.A. 920, 422 F.2d 438, 441, 164 USPQ 619, 622 (CCPA 1970)). Thus, unless a claim sought in the later patent is patentably distinct from the claims in an earlier patent, the claim must be rejected. *See In re Goodman*, 11 F.3d 1046, 1052, 29 USPQ2d 2010, 2015 (Fed.Cir.1993); *Vogel*, 422 F.2d at 441, 164 USPQ at 622. This question is one of law, which we review de novo. *See Goodman*, 11 F.3d at 1052, 29 USPQ2d at 2015; *Texas Instruments Inc. v. United States Int'l Trade Comm'n*, 988 F.2d 1165, 1179, 26 USPQ2d 1018, 1029 (Fed.Cir.1993).

A

[10, 11] The law provides that, in some very rare cases, obvious-type double patenting may be found between design and utility patents. *See Carman Indus., Inc. v. Wahl*, 724 F.2d 932, 939–40, 220 USPQ 481, 487 (Fed.Cir.1983) (noting that, while theoretically possible, "[d]ouble patenting is rare in the context of utility versus design patents"); *In re Thorington*, 57 C.C.P.A. 759, 418 F.2d 528, 536–37, 163 USPQ 644, 650 (CCPA 1969) (Double patenting between a design and utility patent is possible "if the features producing the novel aesthetic effect of a design patent or application are the same as those recited in the claims of a utility patent or application as producing a novel structure."); *In re Phelan*, 40 C.C.P.A. 1023, 205 F.2d 183, 98 USPQ 156 (CCPA 1953); *In re Barber*, 81 F.2d 231, 28 USPQ 187 (CCPA 1936); *In re Hargraves*, 53 F.2d 900, 11 USPQ 240 (CCPA 1931). In these cases, a "two-way" test is applicable. *See Carman*, 724 F.2d at 940, 220 USPQ at 487. Under this test, the obviousness-type double patenting rejection is appropriate only if the claims of the two patents cross-read, meaning that "the test is whether the subject matter of the claims of the patent sought to be invalidated would have been obvious from the subject matter of the claims of the other patent, and vice versa." *Id.*, 724 F.2d 932, 220 USPQ at 487. *See also Braat*, 937 F.2d at 593, 19 USPQ2d at 1292 (explaining two-way test).

B

In making its double patenting rejection, the Board concluded that all but one of the pending claims of Dembiczak's utility application would have been merely an obvious variation of the claims of the earlier-issued design patents—the Dembiczak '023 and '254 references—in light of the Holiday reference. The remaining claim, dependent claim 49, was judged obvious in light of the combination of the Dembiczak design patents, Holiday, and the Kessler reference.

[12, 13] Acknowledging that the two-way test was required by *Carman*, 724 F.2d at 940, 220 USPQ at 487, the Board concluded that "the design claimed in each of appellants' design patents does not exclude the features pertaining to the construction and color of the bag, the use of a plastic material for making the bag, the size or thickness of the bag . . . or the use of various types of filling material. The particular details of the facial indicia would have been a matter of design choice as evidenced by the Holiday handbook," and that therefore, in view of Holiday, the claims of the design patents were obvious variants of the pending utility patent claims. *See Dembiczak*, slip op. at 11. We disagree. In order for a design to be unpatentable because of obviousness, there must first be a basic design reference in the prior art, the design characteristics of which are "basically the same as the claimed design." *In re Borden*, 90 F.3d 1570, 1574, 39 USPQ2d 1524, 1526 (Fed. Cir.1996); *In re Rosen*, 673 F.2d 388, 391, 213 USPQ 347, 350 (CCPA 1982). The phrase "having facial indicia thereon" found in the claims of the pending utility application is not a design reference that is "basically the same as the claimed design." *Borden*, 90 F.3d at 1574, 39 USPQ2d at 1526. In fact, it describes precious little with respect to design characteristics. The Board's suggestion that the design details were simply "a matter of design choice" evinces a misapprehension of the subject matter of design patents. *E.g.*, *Carman*, 724 F.2d at 939 n. 13, 220 USPQ at 486 n. 13 ("Utility patents afford protection for the mechanical structure and function of an invention whereas design patent protection concerns the ornamental or aesthetic features of a design.") Indeed, we note that the two design patents at issue here—the Dembiczak '023 and '254 patents—were considered nonobvious over each other, and were even the subject of a restriction requirement. *See* 35 U.S.C. § 121 (1994) ("If two or more independent and distinct inventions are claimed in one

application, the Commissioner may require the application to be restricted to one of the inventions."); 37 C.F.R. § 1.142. The position adopted by the Board—that a textual description of facial indicia found in the claims of the utility patent application makes obvious the specific designs claimed in the (patentably distinct) Dembiczak design patents—would presumably render obvious, or even anticipate, all design patents where a face was depicted on a bag. But this, of course, is not the law; the textual description cannot be said to be a reference "basically the same as the claimed design," of the design patents at issue here. *Borden*, 90 F.3d at 1574, 39 USPQ2d at 1526 (internal quotation marks omitted). The Board's conclusion of obviousness is incorrect.

Because we find that the Board erred in concluding that the design patents were obvious variants of the pending utility claims, we need not address the other prong of the two-way double patenting test—whether the pending utility claims are obvious variations of the subject matter claimed in the design patents. *See Carman*, 724 F.2d at 939, 220 USPQ at 487 (both prongs of the two-way test required for obviousness-type double patenting). The double patenting rejections are reversed.

IV

Because there is no evidence in the record of a suggestion, teaching, or motivation to combine the prior art references asserted against the pending claims, the obviousness rejections are reversed. In addition, because the Board misapprehended the test for obviousness-type double patenting, and because the pending utility claims do not render obvious the design patents, the double patenting rejections are also reversed.

REVERSED.

KEY NUMBER SYSTEM

In re Werner KOTZAB.

No. 99-1231.

(Reexamination No. 90/004,441).

United States Court of Appeals, Federal Circuit.

June 30, 2000.

In reexamination proceeding, the Board of Patent Appeals and Interferences held that claims in patent involving temperature-controlled injection molding method for forming plastic articles were unpatentable for obviousness. Patentee appealed. The Court of Appeals, Linn, Cir-

not rendered obvious by prior art reference.

Reversed.

1. Patents ⇐16(3)

A claimed invention is unpatentable if the differences between it and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art. 35 U.S.C.A. § 103(a).

2. Patents ⇐16.13

The ultimate determination of whether an invention would have been obvious under the patent statute is a legal conclusion based on underlying findings of fact. 35 U.S.C.A. § 103(a).

3. Patents ⇐113(6)

Court of Appeals reviews de novo an ultimate determination of obviousness by the Board of Patent Appeals and Interferences, but reviews the Board's underlying factual findings for substantial evidence. 35 U.S.C.A. § 103(a).

4. Federal Courts ⇐846

Substantial evidence is something less than the weight of the evidence but more than a mere scintilla of evidence, and, in reviewing the record for substantial evidence, Court of Appeals must take into account evidence that both justifies and detracts from the factual determinations.

5. Patents ⇐113(6)

The possibility of drawing two inconsistent conclusions from the evidence does not prevent findings of the Board of Patent Appeals and Interferences from being supported by substantial evidence; indeed, if a reasonable mind might accept the evidence as adequate to support the factual conclusions drawn by the Board, then Court of Appeals must uphold the Board's determination.

6. Patents ⇐16(3, 4)

Critical step in analyzing the patentability of claims, as to obviousness, is casting the mind back to the time of invention, skill in the art, guided only by the prior art references and the then-accepted wisdom in the field, and close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher. 35 U.S.C.A. § 103(a).

7. Patents ⇐26(1)

Identification in the prior art of each individual part claimed in a patent is insufficient to defeat patentability of the whole claimed invention; rather, to establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant. 35 U.S.C.A. § 103(a).

8. Patents ⇐16.5(1)

Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference. 35 U.S.C.A. § 103(a).

9. Patents ⇐26(1)

The motivation, suggestion, or teaching to combine prior art elements, as would support a finding of obviousness, may come explicitly from statements in the prior art, the knowledge of one of ordinary skill in the art, or, in some cases the nature of the problem to be solved. 35 U.S.C.A. § 103(a).

10. Patents ⇐26(1)

The teaching, motivation, or suggestion to combine prior art elements that would support a finding of obviousness may be implicit from the prior art as a whole, rather than expressly stated in the references; the test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a

ordinary skill in the art. 35 U.S.C.A. § 103(a).

11. Patents ⇐36(1)

Whether the Board of Patent Appeals and Interferences relies on an express or an implicit showing of some motivation, suggestion, or teaching to combine prior art elements, in analyzing obviousness of patent, it must provide particular findings related thereto; broad conclusory statements standing alone are not evidence. 35 U.S.C.A. § 103(a).

12. Patents ⇐16.14

Patent claims involving temperature-controlled injection molding method for forming plastic articles were not rendered obvious by prior art reference, as prior art reference did not teach or suggest use of single temperature sensor to control plurality of flow control valves, as set forth by patent claims. 35 U.S.C.A. § 103(a).

Robert F.I. Conte, Lee, Mann, Smith, McWilliams, Sweeney & Ohlson, of Chicago, Illinois, argued for appellant. Of counsel were Thomas Eugene Smith and James B. Conte.

Mark Nagumo, Associate Solicitor, U.S. Patent and Trademark Office, of Arlington, Virginia, argued for the appellee. With him on the brief were Albin F. Drost, Acting Solicitor, John M. Whealan, Acting Deputy Solicitor, and Stephen Walsh, Associate Solicitor.

Before LOURIE, GAJARSA, and LINN, Circuit Judges.

LINN, Circuit Judge.

DECISION

Werner Kotzab appeals from the final decision of the Board of Patent Appeals and Interferences ("Board") holding claims 1–10 in reexamination number 90/004,441 unpatentable for obviousness under 35 U.S.C. § 103(a). *See Ex Parte Kotzab*, Paper No. 17 (BPAI July 15, 1998). This case was submitted for our decision following oral argument on April 4, 2000. Because findings relating to its obviousness analysis are not supported by substantial evidence, and because the Board erred in concluding that the claims would have been obvious as a matter of law, we reverse.

BACKGROUND

A. The Invention

The invention involves an injection molding method for forming plastic articles. In such methods, the temperature of the mold must be controlled so that the plastic can harden uniformly throughout the mold. Kotzab was confronted with the problem of providing optimal temperature control for an injection molding method to ensure the quality of the final product on the one hand, and achieving optimally short molding cycle times on the other hand. He arrived at a solution which is embodied in claim 1 of the reexamination as follows:

1. An improved method of controlling the temperature of an injection mold by pressure feeding molding material into a mold recess of an injection mold by an extruder, curing the material in the mold, and removing molded material from the mold, said pressure feeding, curing, and removing being a molding cycle of recurring molding cycles and said recurring molding cycles having at least a first molding cycle and a second molding cycle,

comparing a preset nominal temperature to an actual temperature measured by at least one temperature sensor during said first molding cycle and said second molding cycle and supplying an amount of a temperature controlling medium to the first molding cycle and the second molding cycle, said amount of temperature controlling medium being dependent on the deviation between the actual temperature measured and the desired preset nominal temperature, the improvement comprising:

controlling, via a single sensor, a plurali-

ture controlling medium to provide impulse temperature control medium to the first and second molding cycles,

determining empirically or by calculation a quantitative spacial distribution of temperature controlling medium needed to obtain said desired preset nominal temperature during at least the first molding cycle and the second molding cycle and determining empirically or by calculation the conduits needed to be utilized to obtain the desired preset nominal temperature during at least the first molding cycle and the second molding cycle,

comparing said desired preset nominal temperature to said actual temperature, at least once during the first molding cycle and the second molding cycle at a certain point in time being the same for each said molding cycle, such that said comparison made during said first cycle is synchronized with said comparison made during said second subsequent molding cycle, and said plurality of flow control valves are triggered during each said cycle to provide said impulse control medium, and said triggering being dependent on the deviation of temperature determined for each said comparison and also being dependent on a stored profile of said quantitative spacial distribution of the temperature controlling medium.

J.A. at 18–19.

Claim 3, which depends from claim 1, adds the following further limitation: "wherein a flow measuring turbine is associated with each flow control valve to detect the actual flow in each cycle and wherein a proportioning of a cooling or heating medium is effected in dependence on a comparison of a nominal flow to the actual flow." *Id.* at 19.

Claim 10, which depends from claim 3, additionally provides that "the rotation of said measuring turbine is transferred into pulses, so that the nominal flow [of the temperature controlling medium] can be fixed by the presetting of a corresponding number of pulses." *Id.* at 20.

B. The Reexamination Proceeding

U.S. Patent 5,427,720 ("the '720 patent") issued to Kotzab on June 27, 1995. A third party filed a request for reexamination on November 4, 1996. The reexamination was granted and assigned control no. 90/004,441. The amended claims were finally rejected by the Examiner, and Kotzab appealed the rejections to the Board. On July 15, 1998, the Board affirmed the Examiner's rejection of the claims for essentially the reasons expressed in the Examiner's Answer. The Board did, however, provide its own additional comments primarily for emphasis.

Specifically, the Board agreed with the Examiner that WO 92/08598 ("Evans") discloses a process of controlling the temperature of an injection mold by using a sensor to control the pulsing of a temperature control medium through the mold. Moreover, the Board found, as explained by the Examiner, that Evans discloses in a less preferred embodiment, using only one temperature measurement to control the coolant pulses rather than an average temperature measurement. *See* Evans application, p. 6, II. 17–23.

In addition, the Board found that Evans discloses that "the optimum timing of the cooling flow can be selected in accordance with the known temperature of the mould." *Id.* at II. 6–8. Furthermore, the Board found that a prior art promotional article discloses that manipulation of the geometry and layout of the cooling segment provides for the greatest improvement in molding cycle. *See* Horst Wieder, *Understanding the pulse modulated mold temperature control method*, (CITO Products, Inc., WI.) 1987, at p. 1, col. 2, II. 13–16. And, the Board determined that a May 1984 prior art article indicates that it was known to establish a cooling regime before the mold is produced, and that the determination of the cooling regime includes the number and location of the cooling conduits, as well as the volume of the coolant flow. Thus, the Board concluded that the evidence of record indicates that it

was known in the art to utilize empirical data to design the mold and the distribution of cooling channels in that mold. In view of the foregoing, the Board found that the empirical determination of the necessary spacial distribution of the length of the cooling pulses needed for delivering the appropriate coolant is disclosed by Evans or was known at the time the invention was made. Consequently, the Board affirmed the Examiner's rejection of claims 1, 2, and 4–9 under 35 U.S.C. § 103(a) as being unpatentable over Evans.

The Board made additional findings related to claims 3 and 10 in determining that they were also unpatentable under 35 U.S.C. § 103(a) over Evans in view of certain secondary references.

Kotzab filed a request for reconsideration, which the Board denied on November 24, 1998. In that decision, the Board reiterated agreement with the Examiner that it would have been obvious for one of ordinary skill in the art to utilize only one temperature measurement to control the coolant pulses in light of the Evans disclosure. Kotzab timely appealed the Board's decision to this court. We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(4)(A) (1994).

DISCUSSION

A. Standard of Review

[1–3] A claimed invention is unpatentable if the differences between it and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art. *See* 35 U.S.C. § 103(a) (Supp. III 1997); *In re Dembiczak*, 175 F.3d 994, 998, 50 USPQ2d 1614, 1616 (Fed.Cir.1999). The ultimate determination of whether an invention would have been obvious under 35 U.S.C. § 103(a) is a legal conclusion based on underlying findings of fact. *See Dembiczak*, 175 F.3d at 998, 50 USPQ2d at 1616. We review the Board's ultimate determination of obviousness de novo. *See id.* However, we review the Board's underlying factual findings for substantial evidence. *See In re Gartside*, 203 F.3d 1305, 1316, 53 USPQ2d 1769, 1776 (Fed.Cir. 2000).

[4, 5] Substantial evidence is something less than the weight of the evidence but more than a mere scintilla of evidence. *See id.* at 1312, 203 F.3d 1305, 53 USPQ2d at 1773 (quoting *Consolidated Edison Co. v. NLRB*, 305 U.S. 197, 229–30, 59 S.Ct. 206, 83 L.Ed. 126 (1938)). In reviewing the record for substantial evidence, we must take into account evidence that both justifies and detracts from the factual determinations. *See id.* (citing *Universal Camera Corp. v. NLRB*, 340 U.S. 474, 487–88, 71 S.Ct. 456, 95 L.Ed. 456 (1951)). We note that the possibility of drawing two inconsistent conclusions from the evidence does not prevent the Board's findings from being supported by substantial evidence. *See id.* Indeed, if a reasonable mind might accept the evidence as adequate to support the factual conclusions drawn by the Board, then we must uphold the Board's determination. *See id.*

B. Analysis

[6] A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field. *See Dembiczak*, 175 F.3d at 999, 50 USPQ2d at 1617. Close adherence to this methodology is especially important in cases where the very ease with which the invention can be understood may prompt one "to fall victim to the insidious effect of a hindsight syndrome wherein that which only the invention taught is used against its teacher." *Id.* (quoting *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 313 (Fed.Cir.1983)).

[7, 8] Most if not all inventions arise from a combination of old elements. *See In re Rouffet*, 149 F.3d 1350, 1357, 47

every element of a claimed invention may often be found in the prior art. *See id.* However, identification in the prior art of each individual part claimed is insufficient to defeat patentability of the whole claimed invention. *See id.* Rather, to establish obviousness based on a combination of the elements disclosed in the prior art, there must be some motivation, suggestion or teaching of the desirability of making the specific combination that was made by the applicant. *See In re Dance*, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed.Cir. 1998); *In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed.Cir.1984). Even when obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference. *See B.F. Goodrich Co. v. Aircraft Braking Sys. Corp.*, 72 F.3d 1577, 1582, 37 USPQ2d 1314, 1318 (Fed.Cir.1996).

[9–11] The motivation, suggestion or teaching may come explicitly from statements in the prior art, the knowledge of one of ordinary skill in the art, or, in some cases the nature of the problem to be solved. *See Dembiczak*, 175 F.3d at 999, 50 USPQ2d at 1617. In addition, the teaching, motivation or suggestion may be implicit from the prior art as a whole, rather than expressly stated in the references. *See WMS Gaming, Inc. v. International Game Tech.*, 184 F.3d 1339, 1355, 51 USPQ2d 1385, 1397 (Fed.Cir.1999). The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art. *See In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (1981) (and cases cited therein). Whether the Board relies on an express or an implicit showing, it must provide particular findings related thereto. *See Dembiczak*, 175 F.3d at 999, 50 USPQ2d at 1617. Broad conclusory statements standing alone are not "evidence." *Id.*

[12] Kotzab's primary argument that the Board erred in holding claims 1–10 unpatentable under 35 U.S.C. § 103(a) over Evans, or Evans in view of secondary references, is that Evans does not teach or suggest the use of a single temperature sensor to control a plurality of flow control valves. We agree.

As noted previously, the Board adopted the Examiner's reasoning in upholding the rejection of the claims and added further comments. None of the Board's comments relate to the issue of Evans teaching or suggesting the use of one *sensor* to control a number of valves regulating coolant flow to the mold. Thus, we look to the Examiner's reasons for finding this limitation to be expressly taught or suggested in Evans.

The Examiner cites Evans for teaching that "one *system* constructed and operated according to the invention may be used to control a number of valves." Evans application, p. 19, ll. 6–8 (emphasis added). In view of this disclosure only, the Examiner concluded that Evans teaches the use of one *sensor* to control a number of valves. This conclusion must necessarily rest on the unstated premise by the Examiner that "one system" is equal to "one sensor."

But the Board's decision, adopting the Examiner's premise, lacks the necessary substantial evidence to support a rejection of Kotzab's claims. Specifically, there is not substantial evidence to show that "one system" is the same thing as "one sensor." The words "sensor" and "probe" are used throughout Evans to refer to the device that measures the mold temperature. Evans uses the word "signal" to refer to the response generated by the measured temperature that controls the valves for coolant flow. Finally, the word "system" is used in Evans to refer to the overall temperature control system that is responsible for the valve timing for coolant flow to increase or decrease the temperature of the mold. Evans clearly never uses the term "system" as a substitute for the simple temperature measuring device it calls "sensor." And, the Board made no reference to any evidence in the record that

would equate "one system" with "one sensor."

As mentioned previously, more than a mere scintilla of evidence is necessary to support the Board's implicit conclusion that "one system" is equal to "one sensor." Based on the entirety of Evans' disclosure, we cannot say that there is such relevant evidence as a reasonable mind might accept as adequate to support the conclusion that "one system" means "one sensor."

The United States Patent and Trademark Office argues that because Evans teaches that a single sensor may be used to provide "the temperature measurement at a selected part of the machine," it necessarily follows that the Evans "system" discussed later may have a single sensor—and that single sensor may control more than one valve. *See id.* at p. 6, II. 21–23; p. 19, II. 6–8. While the test for establishing an implicit teaching, motivation, or suggestion is what the combination of these two statements of Evans would have suggested to those of ordinary skill in the art, the two statements cannot be viewed in the abstract. Rather, they must be considered in the context of the teaching of the entire reference. Further, a rejection cannot be predicated on the mere identification in Evans of individual components of claimed limitations. Rather, particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed.

We do not take issue with the argument that Evans suggests the concept of using the historic temperature obtained by one temperature measurement to control coolant pulses. *See id.* at p. 5, II. 14–22; p. 6, II. 17–23. However, there is not substantial evidence of record to extrapolate this teaching to the multiple zone system described later in Evans. *See id.* at p. 18, l. 22 to p. 19, l. 8. In the multiple zone system, Evans describes the use of a temperature sensor and an associated flow control valve in each zone. At most, the teaching of Evans suggests that the historic temperature of a mold zone may be measured by one sensor, and as part of a multiple zone system where multiple valves are controlled, that one sensor measurement can be used to control the valve for that zone. Thus, we cannot say that there is such relevant evidence as a reasonable mind might accept as adequate to support the conclusion that where there are a plurality of control valves in a multiple zone setting, only one temperature sensor provides the control for a plurality of valves.

Moreover, we cannot say that there is such relevant evidence as a reasonable mind might accept as adequate to support implicitly the conclusion that a skilled artisan confronted with (1) the problem noted by Kotzab, i.e., providing optimal temperature control for an injection molding method to ensure the quality of the final product on the one hand, and achieving optimally short molding cycle times on the other hand, and (2) the two statements in Evans, would have been motivated to control a plurality of valves in a multiple zone setting with only one temperature sensor.

In this case, the Examiner and the Board fell into the hindsight trap. The idea of a single sensor controlling multiple valves, as opposed to multiple sensors controlling multiple valves, is a technologically simple concept. With this simple concept in mind, the Patent and Trademark Office found prior art statements that in the abstract appeared to suggest the claimed limitation. But, there was no finding as to the specific understanding or principle within the knowledge of a skilled artisan that would have motivated one with no knowledge of Kotzab's invention to make the combination in the manner claimed. In light of our holding of the absence of a motivation to combine the teachings in Evans, we conclude that the Board did not make out a proper *prima facie* case of obviousness in rejecting claims 1, 2, and 4–9 under 35 U.S.C. § 103(a) over Evans. Moreover, because the rejections of claims

conclude that the Board did not make out a proper *prima facie* case of obviousness in rejecting those claims under 35 U.S.C. § 103(a).

CONCLUSION

For the above reasons, we conclude that there is not substantial evidence to support the Board's finding of fact that Evans expressly teaches that "one sensor" may be used to control a plurality of valves, and there is not substantial evidence of record, either expressly or implicitly, to modify the teachings of Evans to obtain a system in which one sensor controls a plurality of valves. Accordingly, we

REVERSE.

In re Robert J. GARTSIDE and Richard C. Norton

No. 99-1241.

United States Court of Appeals, Federal Circuit.

Feb. 15, 2000

In interference proceeding involving patentee and patent applicant, the Board

ting by designation.

of Patent Appeals and Interferences held that claims of patent application, which involved catalytic "cracking" processes, were unpatentable as obvious. Applicant appealed. The Court of Appeals, Lourie, Circuit Judge, held that: (1) Board's factfindings would be reviewed under the substantial evidence standard of the Administrative Procedure Act (APA), abrogating, *Dembiczak*, 175 F.3d 994, *Kemps*, 97 F.3d 1427; (2) Board could retain jurisdiction over, and did not abuse its discretion in deciding, issues of patentability of applicant's claims after patentee withdrew from interference; (3) applicant's claims that corresponded to interference count were unpatentable as obvious; and (4) additional claims that did not correspond to interference count were unpatentable as obvious.

Affirmed.

1. Administrative Law and Procedure ⇐763

Under the arbitrary or capricious standard of review set forth in the Administrative Procedure Act (APA), a reviewing court must consider whether the decision was based on a consideration of relevant factors and whether there has been a clear error of judgment; because the standard is generally deemed to be the most deferential under the APA, the reviewing court analyzes only whether a rational connection exists between the agency's factfindings and its ultimate action. 5 U.S.C.A. § 706(2)(A).

2. Administrative Law and Procedure ⇐791

The substantial evidence standard of review under the Administrative Procedure Act (APA) asks whether a reasonable fact finder could have arrived at the agency's decision and is considered to be a less deferential review standard than the arbitrary or capricious standard. 5 U.S.C.A. § 706(2)(A, E).

3. Administrative Law and Procedure ⇐763

The arbitrary or capricious standard of review under the Administrative Procedure Act (APA) is one of default; thus, that standard applies when the substantial evidence test is deemed inapplicable. 5 U.S.C.A. § 706(2)(A, E).

4. Patents ⇐113(6)

Factfindings of Board of Patent Appeals and Interferences would be reviewed by Court of Appeals under substantial evidence standard of the Administrative Procedure Act (APA), not APA's arbitrary or capricious standard, because Court's review was confined to factual record compiled by Board during agency hearing that was provided by statute. 5 U.S.C.A. §§ 554(a)(1), 706(2)(A, E); 35 U.S.C.A. §§ 7(b), 144.

5. Patents ⇐113(6)

Whether Board of Patent Appeals and Interferences possessed jurisdiction to continue interference proceeding in order to decide patentability of patent applicant's claims, after patentee withdrew from interference, was question of law that Court of Appeals would review de novo.

6. Patents ⇐113(6)

Court of Appeals reviews for an abuse of discretion the decision of the Board of Patent Appeals and Interferences to resolve issues of patentability that were not placed in issue by the parties during the interference; abuse of discretion occurs when a decision is based on an erroneous interpretation of law or factfinding that is not supported by substantial evidence, or if that decision represents an unreasonable judgment in weighing relevant factors. 35 U.S.C.A. § 135(a); 37 C.F.R. § 1.641(a).

7. Patents ⇐314(5)

Whether a claimed invention is unpatentable as obvious is a question of law

based on underlying findings of fact. 35 U.S.C.A. § 103.

8. Patents ⇐314(5)

The presence or absence of a motivation to combine prior art references in an obviousness determination is a pure question of fact. 35 U.S.C.A. § 103.

9. Patents ⇐113(6)

Legal conclusion of obviousness made by Board of Patent and Appeals and Interferences is reviewed de novo, while Board's factual determinations are reviewed for substantial evidence; abrogating, *In re Dembiczak*, 175 F.3d 994, *In re Kemps*, 97 F.3d 1427. 5 U.S.C.A. § 706.

10. Patents ⇐106(1)

Board of Patent Appeals and Interferences could retain jurisdiction over interference proceeding involving patentee and patent applicant after patentee withdrew from interference, to determine issues of patentability as to applicant's claims, rather than having patentability issues decided by examiner ex parte, and Board did not abuse its discretion in deciding patentability of applicant's claims since those issues were fairly raised and fully developed during the proceeding. 35 U.S.C.A. § 135(a).

11. Patents ⇐106(1)

Board of Patent Appeals and Interferences could determine patentability issues raised by administrative patent judge (APJ) sua sponte in interference proceeding, based on the public interest and absence of prejudice to applicant as result of having issues resolved by Board rather than patent examiner.

12. Patents ⇐16.25

Claims of patent application relating to catalytic cracking processes employing a quench were unpatentable due to obviousness, since all of limitations in claimed invention were found in two prior art patents, there was motivation to combine those prior art references, and prior art did not teach away from combining those references, 35 U.S.C.A. § 103(a).

13. Patents ⇐16(2, 3)

The ultimate determination of whether an invention is obvious is a legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the prior art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness. 35 U.S.C.A. § 103(a).

14. Patents ⇐26(1)

Suggestion to combine prior art references that may result in finding of obviousness may come from, inter alia, the teachings of the references themselves and, in some cases, from the nature of the problem to be solved. 35 U.S.C.A. § 103(a).

15. Patents ⇐16.25, 26(2)

Claims of patent application relating to catalytic cracking processes which required a 0.1 to 0.6 second kinetic residence time were unpatentable due to obviousness, as motivation to combine prior art patents containing all claim limitations arose from teachings of the references themselves and nature of problem to be solved, and alleged evidence of unexpected results did not establish nonobviousness. 35 U.S.C.A. § 103(a).

Alan B. Clement, Heidman, Gibson & Costigan, of New York, New York, argued for appellants.

Mark Nagumo, Associate Solicitor, Office of the Solicitor, of Arlington, Virginia, argued for appellee. With him on the brief were Albin F. Drost, Acting Solicitor; John M. Whealan, Acting Deputy Solicitor; and Nancy Mong's Isacson, Associate Solicitor.

Before LOURIE, CLEVENGER, and RADER, Circuit Judges.

LOURIE, Circuit Judge.

Robert J. Gartside and Richard C. Norton (collectively "Gartside") appeal from the final decision of the Board of Patent Appeals and Interferences holding that claims 34, 35, and 37–47 of application Ser. No. 07/798,627 are unpatentable as obvious under 35 U.S.C. § 103. *See Forgac v. Gartside*, Paper No. 72 (BPAI May 21, 1998). Because the Board's factual findings relating to its obviousness analysis are supported by substantial evidence, and because the Board did not err in concluding that the claims were unpatentable as obvious as a matter of law, we affirm.

BACKGROUND

A. *The Invention*

Gartside's application is directed to "cracking" processes, *i.e.*, processes that generate low molecular weight, purified hydrocarbons of desired molecular composition by breaking down impure, high molecular weight hydrocarbon feed oil. Cracking is accomplished by reacting impure feed oil with "solids," particulate matter that induces the breakdown of feed oil by either a thermal or catalytic reaction mechanism. *See* '627 application, J.A. at 63. The claims at issue are all directed to catalytic cracking processes. Independent claim 47 has been argued to us as being "representative" of claims 34, 35, 37–40, and 42–44 and reads as follows:

47. A catalytic process comprising the steps of:

catalytically cracking hydrocarbon feed oil in a reactor of a catalytic cracking unit in the presence of a cracking catalyst at a temperature ranging from 1100 to 1500F to produce a catalytically cracked effluent stream of upgraded oil containing catalyst;

substantially separating said catalyst from said upgraded oil in a separator and a cyclone; and

quenching said upgraded oil downstream of said separator upstream of said cyclone with a quenching oil.

Id. at 51 (paragraphing added). Independent claim 41 is similarly "representative" of dependent claims 45 and 46 and reads as follows:

41. A catalytic process, comprising the steps of:

(a) delivering hot particulate catalytic cracking solids to a catalytic cracking reactor;

(b) delivering a hydrocarbon feed to said reactors;

(c) cracking said hydrocarbon feed in said reactor at a temperature of from 1100 to 1500F to produce a cracked product;

(d) separating said catalytic solids from the cracked product;

(e) quenching said cracked product;

wherein the total residence time from step (a) through step (e) ranges from 0.1 to 0.6 seconds.

Id. at 49 (paragraphing added).

B. *The Interference Proceeding*

Gartside copied claims from Forgac's U.S. Patent 5,043,058, entitled "Quenching Downstream of an External Vapor Catalyst Separator," into the '627 application, attempting to provoke an interference.[1] On February 4, 1994, the Administrative Patent Judge ("APJ") declared the inter-

1. 37 C.F.R. § 1.601(i) defines an "interference" in relevant part as follows:

An interference is a proceeding instituted in the Patent and Trademark Office before the Board to determine any question of patent

ference between Gartside's application and Forgac's patent. *See* Paper No. 17 at 1. The APJ designated Gartside as the "senior party" and Forgac as the "junior party" in the interference, because Gartside's application was accorded an effective filing date prior to March 26, 1990, the filing date of the application that issued as Forgac's patent. *See id.* at 2–3. The APJ also determined that one count encompassed all of the interfering subject matter,[2] *i.e.*, claims 34–47 of the application and claims 1, 2, and 13 of the patent, and that that count corresponded exactly to claim 47 of the application. *See id.* at 3–4.

On September 12, 1995, the APJ issued an order addressing the parties' motions filed during the preliminary motion period. *See* Paper No. 41 at 1–2. Of the parties' eight motions, only two are relevant here: Gartside's motion to designate certain claims as not corresponding to the count, and Forgac's motion for judgment that all of Gartside's claims were unpatentable under 35 U.S.C. § 103. The APJ denied Gartside's motion to designate claims 36, 41, 45, and 46 as not corresponding to the count, concluding that Gartside had failed to show that those claims were patentably distinct from the other claims corresponding to the count. *See generally id.* at 7–11. The APJ granted in part Forgac's motion for judgment that Gartside's claims were invalid under § 103. *See id.* at 11. The APJ first observed that while Forgac's motion was directed to all of Gartside's claims corresponding to the count (claims 34–47), Forgac only performed a § 103 analysis as to claim 47. *See id.* at 11–12. The APJ apparently concluded that this analysis was acceptable with regard to the claims for which Gartside had not presented specific patentability arguments, namely claims 34, 35, 37–40, and 42–44, and indicated that those claims would thus stand or fall based on the arguments made on behalf of claim 47. *See id.* at 12. Since Gartside argued separately the patentability of claims 36, 41, 45, and 46, the APJ indicated that those claims would be considered apart from claim 47. *See id.*

Analyzing the claims that stood or fell with claim 47 first, the APJ held that those claims were unpatentable as obvious under § 103. *See id.* at 12. The APJ based his conclusion on Gartside's U.S. Patent 4,552,645, which teaches a process of thermally cracking feed oil that is nearly identical to the process claimed in claim 47, either alone or in combination with Gartside's U.S. Patent 4,288,235, which discloses apparatus that may be used for both thermal and catalytic processes employing low residence times and quenching to prevent undesired cracking. *See id.* The APJ found that the motivation to combine the thermal cracking teachings of the '645 patent with a catalytic cracking process as disclosed in the '235 patent arose from the nature of the problem to be solved, *viz.*, undesired cracking due to the presence of thermal or catalytic solids. *See id.* at 15. Thus, the APJ concluded that claim 47, as well as claims 34, 35, 37–40, and 42–44, were unpatentable under § 103. *See id.* at 12.

ability and priority of invention between two or more parties claiming the same patentable invention. . . . An interference may be declared between one or more pending applications and one or more unexpired patents naming different inventors when, in the opinion of an examiner, any application and any unexpired patent contain claims for the same patentable invention.

37 C.F.R. § 1.601(i) (1999).

2. 37 C.F.R. § 1.601(f) defines "count" as follows:

A count defines the interfering subject matter between two or more applications or between one or more applications and one or more patents. At the time the interference is initially declared, a count should be broad enough to encompass all of the claims that are patentable over the prior art and designated to correspond to the count.

37 C.F.R. § 1.601(f) (1999).

Having previously concluded that claims 36, 41, 45, and 46 did not stand or fall with claim 47, the APJ proceeded to analyze those claims as if Forgac had not placed their patentability at issue. The APJ held, *sua sponte*, that claims 36, 41, 45, and 46 were unpatentable under § 103, based on the '645 patent in view of U.S. Patent 4,419,221 (Castagnos), or on those two patents in view of the '235 patent, incorporating his reasoning with respect to claims 34, 35, 37–40, 42–44, and 47. *See id.* at 18–19. As noted above, essentially all of the limitations of claims 34, 35, 37–40, 42–44, and 47 were found in the combination of the '645 patent with the '235 patent. Since claims 36, 41, 45, and 46 each contain all of those limitations, as well as an additional kinetic residence time limitation, the APJ needed to add one additional reference to complete the combination. Accordingly, the APJ added Castagnos to the '645 and '235 patent combination, as Castagnos discloses the precise kinetic residence time recited in claims 36, 41, 45, and 46. *See id.* at 19–20. The APJ again found that the motivation to combine the teachings of the patents arose from the nature of the problem to be solved, *i.e.*, optimizing yields by avoiding undesired cracking. *See id.* at 20.[3]

Gartside requested reconsideration of the denial of his motion to redesignate claims 36, 41, 45, and 46 as not corresponding to the count, *see* Paper No. 45, and the granting in part of Forgac's motion to hold Gartside's claims unpatentable under § 103, *see* Paper No. 43. On reconsideration, the APJ denied both of these requests. *See* Paper No. 49. As for the *sua sponte* holdings of unpatentability, Forgac and Gartside each filed timely responses,[4] neither of which persuaded the examiner to depart from his earlier holdings, *see* Paper No. 50 at 15. The APJ then ordered the parties to show cause why judgment should not be entered against them with respect to the patentability of all the claims corresponding to the count. *See id.* In response, Forgac and Gartside each requested a final hearing before the Board. *See* Paper Nos. 51 and 54.

On May 20, 1996, Forgac withdrew his request for a final hearing and authorized the APJ to cancel claims 1, 2, and 13 from the '058 patent. *See* Paper No. 63 at 1–2. Despite Forgac's withdrawal from the interference, the APJ held that the interference should proceed based on our decision in *Perkins v. Kwon*, 886 F.2d 325, 12 USPQ2d 1308 (Fed.Cir.1989), as the issues surrounding the patentability of Gartside's claims had been fairly placed at issue and fully developed during the interference, and they therefore should be resolved for the sake of the public interest. *See* Paper No. 64 at 3–5. Gartside requested reconsideration of this order and asked that his application be remanded to the primary examiner for further prosecution. *See* Paper No. 65 at 1. The APJ dismissed both requests, *see* Paper No. 66, and a final hearing was held on May 21, 1998.

The Board first held that the APJ properly concluded that the Board retained jurisdiction over the patentability issues raised in the interference. See *Gartside*, Paper No. 72 at 9. The Board reasoned that under our decision in *Schulze v. Green*, 136 F.3d 786, 45 USPQ2d 1770 (Fed.Cir.1998), the Board should decide

3. Although not appealed here, the APJ also concluded that claims 1, 2, and 13 of Forgac's '058 patent were all unpatentable under § 103 based on the '645 patent and U.S. Patent 4,764,268, or over those two references in combination with the '235 patent. See id. at 21.

4. The APJ noted that in his response, Gartside had not contested the APJ's sua sponte holding that claim 36 was unpatentable (Paper No. 47), *see* Paper No. 50 at 14, and the APJ thus rendered judgment accordingly. Likewise, the Board did not address this claim in its final decision, *see* Paper No. 72 at 10 n. 10, and Gartside does not argue the patentability of claim 36 on appeal.

the patentability issues despite Forgac's withdrawal, as those issues were fairly raised and fully developed in the course of the interference. *See id.* at 7–9. The Board also noted that Gartside was not procedurally disadvantaged by the Board's decision to retain jurisdiction rather than remand to the examiner. *See id.* at 6–7.

Turning to the merits, the Board concluded that the APJ did not abuse his discretion[5] in holding that claims 34, 35, 37–40, 42–44 and 47 of the '627 application were unpatentable under § 103. *See id.* at 19. The Board agreed with the APJ that those claims would have been obvious based on the '645 patent alone or in combination with the '235 patent. *See id.* at 19. The Board also agreed with the APJ that the motivation to combine those references arose from the nature of the problem to be solved, *viz.*, minimizing undesired cracking. *See id.* at 15.

As for claims 41, 45, and 46, the Board first held that the APJ did not abuse his discretion in denying Gartside's motion to redesignate those claims as not corresponding to the count, reasoning that Gartside had failed to show that those claims were patentably distinct from the other claims corresponding to the count. *See id.* at 21–22, 27. The Board further held that the APJ did not abuse his discretion in holding *sua sponte* that those claims were unpatentable under § 103 based on the combination of the '645 patent and the Castagnos patent, or those two patents in view of the '235 patent, *see id.* at 28–29, and that a motivation to combine them arose from the nature of the problem to be solved (minimizing undesired cracking) and from the references themselves, *see id.* at 25–27. The Board also found that Gartside's evidence of unexpected results in the form of the "second Johnson declaration" was unpersuasive, as that evidence did not pertain to the same process as that of the claims at issue. *See id.* at 35–36.

DISCUSSION

A. *Standards of Review*

1. *Review of Factfinding by the Board of Patent Appeals and Interferences*

In *Dickinson v. Zurko*, 527 U.S. 150, 119 S.Ct. 1816, 144 L.Ed.2d 143, 50 USPQ2d 1930 (1999), the Supreme Court reversed our en banc decision that held that the appropriate standard of review of PTO findings of fact is the clearly erroneous standard, *see In re Zurko*, 142 F.3d 1447, 1449, 46 USPQ2d 1691, 1693 (Fed.Cir. 1998), and held that we must apply one of the standards set forth in the Administrative Procedure Act ("APA") at 5 U.S.C. § 706 (1994), *see Zurko*, 119 S.Ct. at 1818. Section 706 reads in relevant part as follows:

> § 706. Scope of Review
>
> The reviewing court shall—
>
> * * * * * * *
>
> (2) hold unlawful and set aside agency action, findings, and conclusions found to be—
>
> (A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law;
>
> * * * * * * *
>
> (E) unsupported by substantial evidence in a case subject to sections 556 and 557 of this title or otherwise reviewed on the record of an

5. 37 C.F.R. § 1.655(a) sets forth the Board's standard of review with respect to interlocutory orders entered by the APJ:

> The Board may also consider whether entry of any interlocutory order was an abuse of discretion. All interlocutory orders shall be presumed to have been correct, and the burden of showing an abuse of discretion shall be on the party attacking the order.

37 C.F.R. § 1.655(a) (1999).

agency hearing provided by statute ...

5 U.S.C. § 706(2)(A), (E) (1994). In *Zurko*, the Supreme Court did not determine whether the correct standard of review for PTO findings of fact is the "arbitrary, capricious" or the "substantial evidence" test. *See Zurko*, 527 U.S. 150, 119 S.Ct. at 1821, 144 L.Ed.2d 143, 50 USPQ2d at 1934. We feel compelled to decide that question, in order to secure the standard of review through which we will test the decision of the Board in this case.

[1] The Supreme Court has indicated that the "arbitrary, capricious" standard of review is highly deferential. Under that standard, a reviewing court "must consider whether the decision was based on a consideration of relevant factors and whether there has been a clear error of judgment." *Citizens to Preserve Overton Park, Inc. v. Volpe*, 401 U.S. 402, 416, 91 S.Ct. 814, 28 L.Ed.2d 136 (1971). Because this standard is generally considered to be the most deferential of the APA standards of review, *see e.g.*, 6 Stein et al., *Administrative Law* § 51.03, at 51–117 (1999) ("The narrowest scope of judicial review of an agency['s] fact findings is afforded by the arbitrary, capricious, or abuse of discretion test."), the reviewing court analyzes only whether a rational connection exists between the agency's factfindings and its ultimate action, *see Hyundai Elecs. Indus. Co. v. ITC*, 899 F.2d 1204, 1209, 14 USPQ2d 1396, 1400 (Fed.Cir.1990) (noting that the "touchstone" of the "arbitrary, capricious" standard is rationality); see also 6 *Administrative Law* § 51.03, at 51–128.

[2] On the other hand, the "substantial evidence" standard asks whether a reasonable fact finder could have arrived at the agency's decision, *see Consolidated Edison Co. v. NLRB*, 305 U.S. 197, 229, 59 S.Ct. 206, 83 L.Ed. 126 (1938); *see generally* 3 Charles H. Koch, Jr., *Administrative Law and Practice* § 10.3[1], at 22–26 (2d ed.1997), and is considered to be a less deferential review standard than "arbitrary, capricious." *See American Paper Inst., Inc. v. American Elec. Power Serv. Corp.*, 461 U.S. 402, 412–13 n. 7, 103 S.Ct. 1921, 76 L.Ed.2d 22 (1983) (characterizing the "arbitrary, capricious" standard as "more lenient" than the "substantial evidence" standard); *Abbott Lab. v. Gardner*, 387 U.S. 136, 143, 87 S.Ct. 1507, 18 L.Ed.2d 681 (1967) (characterizing "substantial evidence" review as "more generous judicial review" than "arbitrary, capricious" review). The Supreme Court has described "substantial evidence" in the following manner:

> Substantial evidence is more than a mere scintilla. It means such relevant evidence as a reasonable mind might accept as adequate to support a conclusion.... Mere uncorroborated hearsay or rumor does not constitute substantial evidence.

Consolidated, 305 U.S. at 229–30, 59 S.Ct. 206 (citations omitted); see *also AK Steel Corp. v. United States*, 192 F.3d 1367, 1371 (Fed.Cir.1999) (quoting *Consolidated*). The Court has emphasized that "substantial evidence" review involves examination of the record as a whole, taking into account evidence that both justifies and detracts from an agency's decision. *See Universal Camera Corp. v. NLRB*, 340 U.S. 474, 487–88, 71 S.Ct. 456, 95 L.Ed. 456 (1951). The Court has also stated, however, that "the possibility of drawing two inconsistent conclusions from the evidence does not prevent an administrative agency's finding from being supported by substantial evidence." *See Consolo v. Federal Maritime Comm'n*, 383 U.S. 607, 620, 86 S.Ct. 1018, 16 L.Ed.2d 131 (1966).

[3] Moreover, courts have recognized that the "arbitrary, capricious" standard is one of default. *See Association of Data Processing Serv. Orgs., Inc. v. Board of Governors of Fed. Reserve Sys.*, 745 F.2d

677, 683 (D.C.Cir.1984) (the "arbitrary, capricious" standard "is a catch-all, picking up administrative misconduct not covered by the other more specific paragraphs."); *see also Olenhouse v. Commodity Credit Corp.*, 42 F.3d 1560, 1575 n. 25 (10th Cir. 1994). In other words, the "arbitrary, capricious" standard applies when the "substantial evidence" test of section 706(2)(E) is deemed inapplicable. *See Aircraft Owners & Pilots Ass'n v. FAA*, 600 F.2d 965, 969 (D.C.Cir.1979). Thus, we return to the statute.

[4] Section 706(2)(E) provides that "substantial evidence" review is afforded to agency factfinding performed during an adjudication in two circumstances: (1) factfinding performed in "a case subject to sections 556 and 557 of this title," and (2) factfinding performed in a case "reviewed on the record of an agency hearing provided by statute." 5 U.S.C. § 706(2)(E). Factfinding by the Board does not fall within the first category, as § 554 excludes PTO adjudication from the trial-type procedures set forth in 5 U.S.C. §§ 556 and 557. Specifically, section § 554(a)(1) excludes agency adjudication from these requirements when the subject matter of that adjudication is subject to a subsequent trial *de novo*, *see* 5 U.S.C. § 554(a)(1) (1994),[6] as in the case of Board adjudication, *see* 35 U.S.C. § 145 (1994) ("Civil action to obtain a patent"); *id.* § 146 (1994) ("Civil action in case of interference"). Accordingly, these interrelated statutes dictate that Board factfinding does not fall within the first category of § 706(2)(E).

We next consider whether our review of Board factfindings made in the course of its adjudicatory proceedings falls within the second category of § 706(2)(E), *i.e.*, "or otherwise reviewed on the record of an agency hearing provided by statute." 5 U.S.C. § 706(2)(E). Section 144 explicitly provides that we must review Board decisions "on the record" developed by the PTO, *see* 35 U.S.C. § 144 (1994) ("The United States Court of Appeals for the Federal Circuit shall *review* the decision from which an appeal is taken *on the record* before the Patent and Trademark Office.") (emphasis added), and it is for this reason that the Commissioner is required to convey the record to us in the event of an appeal, *see id.* § 143. Moreover, the "hearing" upon which the "record" is based is "provided by" 35 U.S.C. § 7(b), which states that:

> The Board of Patent Appeals and Interferences shall, on written appeal of an applicant, review adverse decisions of examiners upon applications for patents and shall determine priority and patentability of invention in interferences declared under section 135(a) of this title.
>
> Each appeal and interference shall be *heard* by at least three members of the Board of Patent Appeals and Interferences, who shall be designated by the Commissioner. Only the Board of Patent Appeals and Interferences has the authority to grant *rehearings*.

35 U.S.C. § 7(b) (1994) (emphasis added). Thus, the plain language of §§ 7 and 144 of Title 35 indicates that we review Board decisions "on the record of an agency hearing provided by statute," and that we should therefore review Board factfinding for "substantial evidence." *See also* Thomas Leonard Stoll, *A Clearly Erroneous Standard of Review*, 79 J. Pat. &

6. Section 554(a)(1) provides that:

> (a) This section applies, according to the provisions thereof, in every case of adjudication by statute to be determined on the record after opportunity for an agency hearing, *except* to the extent that there is involved—
>
> (1) a matter subject to a subsequent trial of the law and the facts de novo in a court.

5 U.S.C. § 554(a)(1) (1994) (emphasis added).

Trademark Off. Soc'y 100, 106 (1997) (arguing in favor of "substantial evidence" review based on 35 U.S.C. §§ 7(b) and 144).

In appeals from the Board, we have before us a comprehensive record that contains the arguments and evidence presented by the parties, including all of the relevant information upon which the Board relied in rendering its decision. *See* 35 U.S.C. § 143 (1994) ("[T]he Commissioner shall transmit to the United States Court of Appeals for the Federal Circuit a certified list of the documents comprising the record in the Patent and Trademark Office."). That record, when before us, is closed, in that the Board's decision must be justified within the four corners of that record. The record before us on appeal thus dictates the parameters of our review. We cannot look elsewhere to find justification for the Board's decision. Furthermore, the record reflects the results of a proceeding in the PTO during which the applicant has been afforded an opportunity to bring forth the facts thought necessary to support his or her position. Accompanying the record is a detailed opinion from the Board. We have expressly held that the Board's opinion must explicate its factual conclusions, enabling us to verify readily whether those conclusions are indeed supported by "substantial evidence" contained within the record. *See Gechter v. Davidson*, 116 F.3d 1454, 1460, 43 USPQ2d 1030, 1035 (Fed.Cir.1997) ("[W]e hold that the Board is required to set forth in its opinions specific findings of fact and conclusions of law adequate to form a basis for our review.").

In addition to the statutory language discussed above, Supreme Court precedent and the law of our sister circuits also indicate that "substantial evidence" review is appropriate in view of the plenary nature of the record before us. The Supreme Court has stated generally that the "basic requirement" for "substantial evidence" review is that the agency hearing produce a record that serves as the foundation for the agency's action. *See Overton Park*, 401 U.S. at 415, 91 S.Ct. 814; *Camp v. Pitts*, 411 U.S. 138, 141, 93 S.Ct. 1241, 36 L.Ed.2d 106 (1973) (noting that "substantial evidence" review "is appropriate when reviewing findings made on a hearing record"). In *Zurko* the Court echoed these prior decisions when it intimated that "substantial evidence" review is the appropriate standard for our review of Board factfinding. *See Zurko*, 119 S.Ct. at 1823 ("A reviewing court reviews an agency's reasoning to determine whether it is 'arbitrary' or 'capricious,' or, if bound up with a record-based factual conclusion, to determine whether it is supported by 'substantial evidence.' ").

Chrysler Corp. v. DOT, 472 F.2d 659 (6th Cir.1972), is instructive. In that case, the court had to determine whether the "arbitrary, capricious" or the "substantial evidence" test should be applied to automobile safety standards promulgated by the Secretary of Transportation. Those standards emerged from a statutorily mandated agency rulemaking hearing that was not "formal" in the sense of cases subject to sections 556 and 557 of the APA. The agency argued that the appropriate standard of review was the most deferential "arbitrary, capricious" standard, because the promulgated safety standards emerged not from formal adjudication, but from informal rulemaking. *See id.* at 667. To the contrary, the industry petitioners argued that the default standard should not apply, because the safety standards arose from hearings compelled by statute, and the scope of appellate review was confined to the record made before the agency in the informal rulemaking process. *See id.* The court concluded that the "substantial evidence" test of section 706(2)(E) should apply because the agency was required by law to compile a record that would restrict the scope of appellate review. *See id.* at

668. Consequently, only the evidence in the record could be used by the appellate court to justify or refute the agency action. In contrast, the court noted that when an agency decision is made on "the basis of data contained in its own files or on its own views or opinions . . . a reviewing court cannot test the rules as promulgated against the evidence in the agency's record." *Id.* at 669. In those circumstances, the more deferential standard of review would be appropriate.[7]

The reasoning of the D.C. Circuit also supports our conclusion that "substantial evidence" review applies when the reviewing court must confine its review of agency factfinding to the record produced by the agency proceeding. In *Data Processing*, the D.C. Circuit considered the APA standards of review, and concluded that "[t]he distinctive function of paragraph (E)—what it achieves that paragraph (A) does not—is to require substantial evidence to be found *within the record of closed-record proceedings* to which it exclusively applies." *Data Processing*, 745 F.2d at 684 (emphasis added); *see also id.* at 683 ("The ['substantial evidence' test] is only a specific application of the ['arbitrary, capricious' test], separately recited in the APA . . . to emphasize that in the case of [section 706(2)(E)] proceedings the factual support must be found in the closed record as opposed to elsewhere.").

Because our review of the Board's decision is confined to the factual record compiled by the Board, we accordingly conclude that the "substantial evidence" standard is appropriate for our review of Board factfindings. *See* 5 U.S.C. § 706(2)(E).

2. Other Applicable Standards of Review

[5, 6] Whether the Board possessed jurisdiction to continue the interference in order to decide the patentability of Gartside's claims is a question of law that we review de novo. *See James M. Ellett Constr. Co. v. United States*, 93 F.3d 1537, 1541 (Fed.Cir.1996) ("Jurisdiction is a question of law [that] . . . we review *de novo*."). We review for an abuse of discretion the Board's decision to resolve issues of patentability that were not placed in issue by the parties during the interference. *See* 35 U.S.C. § 135(a) (providing that the Board "*may* determine questions of patentability" during the course of an interference) (emphasis added); 37 C.F.R. § 1.641(a) (1999);[8] *Perkins*, 886 F.2d at 328, 12 USPQ2d at 1311 ("The word 'may' in § 135(a) accommodates the situation when patentability is not placed at issue during the priority contest, but it would contradict the remedial purpose of the legislation if the Board could refuse to decide questions of patentability for which there had been adduced an appropriate record."). An abuse of discretion occurs when a decision is based on an erroneous

7. We recognize that a distinction has been drawn between formal and informal proceedings to determine which APA standard to apply, with the most deferential standard thought to be applicable in reviewing agency decisions made in informal settings. *See* 6 *Administrative Law* § 51.01[2], at 51-48. This distinction alone, however, cannot dispositively answer the standard of review question when an agency hearing is compelled by a law that also requires a closed record to be made of the proceeding, and Congress has limited the scope of appellate review to the record made of the agency's deliberations.

8. Section 1.641(a) provides that:

> During the pendency of the interference, if the administrative patent judge becomes aware of a reason why a claim designated to correspond to a count may not be patentable, the administrative patent judge *may* enter an order notifying the parties of the reason and set a time within which each party may present its views, including any argument and any supporting evidence, and, in the case of the party whose claim may be unpatentable, any appropriate preliminary motions under §§ 1.633(c), (d) and (h).

37 C.F.R. § 1.641(a) (1999) (emphasis added).

interpretation of law or clearly erroneous factfinding, or if that "decision represents an unreasonable judgment in weighing relevant factors." *A.C. Aukerman Co. v. R.L. Chaides Constr. Co.*, 960 F.2d 1020, 1039, 22 USPQ2d 1321, 1333 (Fed.Cir. 1992) (en banc). In view of our holding that we review Board factfinding for substantial evidence, we will modify the second criterion accordingly.

[7–9] Whether a claimed invention is unpatentable as obvious under § 103 is a question of law based on underlying findings of fact. *See In re Dembiczak*, 175 F.3d 994, 998, 50 USPQ2d 1614, 1616 (Fed. Cir.1999) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17–18, 86 S.Ct. 684, 15 L.Ed.2d 545, 148 USPQ 459, 467 (1966)). The presence or absence of a motivation to combine references in an obviousness determination is a pure question of fact. *See id.* at 1000, 50 USPQ2d at 1617. The Board's legal conclusion of obviousness is reviewed *de novo*. *See In re Rouffet*, 149 F.3d 1350, 1355, 47 USPQ2d 1453, 1455 (Fed.Cir.1998); *see also* 5 U.S.C. § 706 (1994) ("To the extent necessary to decision and when presented, the reviewing court shall decide all relevant questions of law . . ."). Although we have previously reviewed the Board's factual determinations in an obviousness analysis for clear error, *see Dembiczak*, 175 F.3d at 998, 50 USPQ2d at 1616; *Kemps*, 97 F.3d at 1429–30, 40 USPQ2d at 1311–12, we now review them for substantial evidence.

B. *Jurisdiction*

[10] Gartside argues that the Board erred in retaining jurisdiction over the interference proceeding, as no interfering subject matter remained after Forgac's withdrawal from the interference. Gartside thus contends that the interference should have been dissolved and that the patentability issues should have been decided by the examiner *ex parte*. Gartside further asserts that the Board abused its discretion in addressing those issues, as the public interest relied on in *Perkins v. Kwon* was not here implicated, and the denial of remand to the examiner deprived him of certain procedural safeguards, *e.g.*, the right to amend, refile as a continuation application, and present evidence of unexpected results.

Citing *Guinn v. Kopf*, 96 F.3d 1419, 40 USPQ2d 1157 (Fed.Cir.1996), the Commissioner responds that Forgac's withdrawal did not divest the Board of jurisdiction to decide the patentability issues developed during the interference, and that under *Perkins*, the Board must decide all issues fairly raised and fully developed during the interference. The Commissioner further contends that the Board did not abuse its discretion in deciding the patentability of Gartside's claims because the public interest in *Perkins* was implicated and Gartside was denied no procedural safeguards, as Gartside's procedural options in the interference paralleled his options in *ex parte* examination.

Section 135(a) sets forth the Commissioner's authority to declare interference proceedings and the Board's jurisdiction to resolve issues relating to priority and patentability that arise during such proceedings. Section 135(a) provides in relevant part that:

> (a) Whenever an application is made for a patent which, in the opinion of the Commissioner, would interfere with any pending application, or with any unexpired patent, an interference may be declared and the Commissioner shall give notice of such declaration to the applicants, or the applicant and patentee, as the case may be. The Board of Patent Appeals and Interferences *shall* determine questions of priority of the inventions and *may* determine questions of patentability.

35 U.S.C. § 135(a) (1994) (emphasis added). In *Perkins*, we held that under

§ 135(a), the Board *should* decide issues relating to priority and patentability that are fairly raised and fully developed during the interference, despite the permissive language of § 135(a) with respect to patentability issues. *See Perkins*, 886 F.2d at 328–29, 12 USPQ2d at 1310–11; see also *Schulze*, 136 F.3d at 792, 45 USPQ2d at 1774–75; *Wu v. Wang*, 129 F.3d 1237, 1242, 44 USPQ2d 1641, 1645 (Fed.Cir.1997). We noted that the permissive language addresses "the situation when patentability is not placed at issue during the priority contest, but it would contradict the remedial purpose of the legislation if the Board could refuse to decide questions of patentability for which there had been adduced an appropriate record." *See Perkins*, 886 F.2d at 328, 12 USPQ2d at 1311.

In *Guinn* we extended *Perkins*, holding that even when a party attempts to terminate the interference by disclaiming all of its claims relating to the count, the Board should decide priority when priority issues have been fairly raised and fully developed at the Board. *See Guinn*, 96 F.3d at 1421–22, 40 USPQ2d at 1159. In that case, Guinn attempted to terminate the interference by disclaiming his one claim that corresponded to the count, *see* 35 U.S.C. § 253 (1994), and moving to dismiss for lack of jurisdiction on the basis of a lack of controversy. *See Guinn*, 96 F.3d at 1420, 40 USPQ2d at 1158. Guinn argued that absent a priority dispute, the Board lacked jurisdiction to enter judgment against him in the interference pursuant to 37 C.F.R. § 1.662. *See id.* Rather than dismiss, however, the Board entered judgment against Guinn. *See id.*

Guinn appealed and we affirmed, holding that the disclaimer of all the claims corresponding to a count did not divest the Board of jurisdiction over the interference. *See id.* at 1421–22, 40 USPQ2d at 1159. We reasoned that once an interference has been properly declared, § 135(a) directs that the Board "shall determine questions of priority," and that under *Perkins*, the Board should resolve priority issues that have been fully developed before the Board. *See id.*

Based on *Perkins* and *Guinn*, we agree with the Commissioner that Forgac's withdrawal did not divest the Board of jurisdiction over the interference, and that the Board did not abuse its discretion in deciding the patentability of Gartside's claims. Even though *Guinn* involved a remaining issue of priority rather than patentability, we agree with the Commissioner that *Guinn* is sufficiently on point. In Forgac's notice to withdraw his request for a final hearing, Forgac authorized the APJ to cancel claims 1, 2, and 13 from the '058 patent, *see* Paper No. 63 at 2, the functional equivalent of Guinn disclaiming his claims corresponding to the count under § 253. Likewise, neither party here disputes that the interference was properly declared. While part of our reasoning in *Guinn* hinged on the fact that § 135(a) mandates that the Board "*shall* determine questions of priority," in *Perkins* we interpreted the language "*may* determine issues of patentability" as nearly mandatory when those issues have been fairly raised and fully developed before the Board. *See Perkins*, 886 F.2d at 328–29, 12 USPQ2d at 1310–11. Moreover, as with the priority issues in *Guinn*, the issues surrounding the patentability of Gartside's claims were fairly raised and fully developed during the proceeding.[9] Accordingly, we conclude that the Board properly resolved these issues under § 135(a).

9. Prior to Forgac's withdrawal, Forgac raised the issue of the patentability of all of Gartside's claims in a preliminary motion to the APJ. Gartside opposed that motion, and Forgac in turn replied to that opposition. *See* Papers No. 20, 29, and 36. Following the APJ's granting-in-part of Gartside's motion, Gartside further developed this issue in his request for reconsideration. *See* Papers No. 41 and 43. Moreover, the APJ independently raised and developed the issue of the patentability of claims 41, 45, and 46 in his *sua*

[11] As we noted *supra*, the APJ raised the issue of the patentability of claims 41, 45, and 46 *sua sponte*. To the extent that the *sua sponte* holding meant that Forgac did not properly place the patentability of these claims at issue before the Board, we agree with the Commissioner that the Board acted within its discretion to decide the patentability of those claims based on the public interest as noted in *Perkins* and the fact that Gartside was in no way prejudiced by resolution of those issues by the Board rather than the examiner.

First, the public interest as discussed in *Perkins* is clearly served by the Board's resolution of the patentability issues surrounding Gartside's claims. The Board had already addressed the patentability issues with respect to claims 34, 35, 37–40, and 42–44, and the validity of claims 41, 45, and 46 turned on two of the same references used to invalidate those other claims. By deciding the patentability of claims 41, 45, and 46, the Board avoided yet another round of duplicative arguments before the examiner and achieved a timely resolution to the benefit of the parties and the public in general. As we stated in *Perkins*:

> The Board, by resolving both priority and patentability when these questions are fully presented, settles not only the rights between the parties but also rights of concern to the public. The public interest in the benefits of a patent system is best met by procedures that resolve administratively questions affecting patent validity that arise before the PTO. To do otherwise is contrary to the PTO's mission to grant presumptively valid patents, 35 U.S.C. § 282, and thus disserves the public interest.

Perkins, 886 F.2d at 328–29, 12 USPQ2d at 1311.

Moreover, we agree with the Commissioner that Gartside was not denied any procedural safeguards by the Board's refusal to remand to the examiner. Gartside was afforded the opportunity to redefine the interfering subject matter by amending his claims, *see* 37 C.F.R. § 1.633(c)(2) (1999), and he was free to file a continuation application, *see* 37 C.F.R. § 1.633(d) (1999); *see also* 35 U.S.C. § 120 (1994). Moreover, 37 C.F.R. § 1.639 permits a party to introduce evidence in support of motions, oppositions, and replies, and 37 C.F.R. § 1.640(e)(3) also enables a party to introduce evidence in response to an order to show cause. Although Gartside alleges that he was prejudiced for want of other assorted procedural safeguards, these allegations are similarly without merit.

In sum, we conclude that the Board did not err in retaining jurisdiction over the interference to decide the patentability of Gartside's claims.

C. *The Patentability of Claims 34, 35, 37–40, 42–44 and 47*

[12] Gartside argues that the Board erred in holding claims 34, 35, 37–40, 42–44, and 47 unpatentable under § 103, because the references do not teach or suggest the claimed invention. Gartside principally contends that the '645 and '235 patents are directed to *thermal* cracking processes, and that there was no suggestion in the art to employ a quench step in *catalytic* cracking processes. Gartside further asserts that the '235 patent teaches away from employing a quench in catalytic cracking. The Commissioner responds that the claims would have been obvious over Gartside's '645 and '235 patents, as those references contain each and every element of the claimed processes. The Commissioner argues that one of ordinary

sponte holding of unpatentability, to which Gartside also responded. *See* Papers No. 41 and 47. Even after Forgac's withdrawal, Gartside was provided with additional opportunities to develop the patentability issues before the Board. *See* Gartside's BPAI Br. 21–24, 27–30.

skill in the art would have been motivated to combine the '645 and '235 patents, as they both attempt to solve the same problem, *viz.*, continued thermal cracking of the cracked product. The Commissioner also contends that the '235 patent does not teach away from employing a quench in catalytic cracking.

[13, 14] A claimed invention is unpatentable as obvious "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." 35 U.S.C. § 103(a) (1994); *see Dembiczak*, 175 F.3d at 998, 50 USPQ2d at 1616. "The ultimate determination ... whether an invention is or is not obvious is a legal conclusion based on underlying factual inquiries including: (1) the scope and content of the prior art; (2) the level of ordinary skill in the prior art; (3) the differences between the claimed invention and the prior art; and (4) objective evidence of nonobviousness." *Dembiczak*, 175 F.3d at 998, 50 USPQ2d at 1616 (citing *Graham*, 383 U.S. at 17–18, 86 S.Ct. 684, 15 L.Ed.2d 545, 148 USPQ at 467). We have further indicated "that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references." *Id.* at 999, 50 USPQ2d at 1617. That suggestion may come from, *inter alia*, the teachings of the references themselves and, in some cases, from the nature of the problem to be solved. *See Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1573, 37 USPQ2d 1626, 1630 (Fed.Cir.1996); *Rouffet*, 149 F.3d at 1355, 47 USPQ2d at 1456.

We agree with the Commissioner that substantial evidence supports the Board's factfinding and that the Board correctly concluded that the claims were unpatentable under § 103. As an initial matter, we agree with the Commissioner that substantial evidence supports the Board's finding that Gartside's '645 and '235 patents contain all the limitations set forth in claim 47. *See Gartside*, Paper No. 72 at 12–13. The Board found that all the limitations of claim 47 are found in the '645 patent, except that the '645 patent accomplishes cracking by a thermal rather than a catalytic mechanism. *See Gartside*, Paper No. 72 at 13. This finding is clearly supported by the following disclosure in the '645 patent:

> [T]he reaction proceeds at 1500° F for a residence time of about 0.05 to 0.40 seconds, preferably form [sic] 0.20 to 0.30. The product gases are separated from the solids in separator 8 . . . and the product gases pass overhead through a line 22 and are immediately quenched with typical quench oil that is delivered to line 22 through line 36. The quenched product is passed through a cyclone 24 where entrained solids are removed . . .

'645 patent, col. 2, l. 62 to col. 3, l. 2. The Board found the missing limitation in the '235 patent, which teaches that the claimed apparatus may be used in catalytic cracking processes involving quenching and separation steps as in claim 47. *See Gartside*, Paper No. 72 at 13 (citing '235 patent, col. 4, ll. 42–47). Based on the foregoing, we conclude that the Board's finding that all of the limitations of the claimed invention are found in Gartside's '645 and '235 patents is supported by substantial evidence.

Gartside further contends that the Board erred in finding that sufficient motivation existed to combine the '645 and '235 patents to arrive at the invention in claim 47. *See id.* at 14. We disagree. As the Board indicates, the '645 patent addresses the problem of hot particulate solids con-

tinuing to crack the product after the desired thermal cracking reaction has been completed, solving that problem by applying a quench after primary separation of cracking particles from the product. *See* Paper No. 72 at 14–15. The Board further found that the '235 patent suggests that the presence of either hot thermal *or* hot catalytic solids in the product stream may cause undesired cracking. *See id.* at 15 (citing '235 patent, col. 1, ll. 6–10). These disclosures provide substantial evidence supporting the Board's finding that one of ordinary skill in the art would have been motivated also to apply the teachings of the '645 patent relating to arresting undesired cracking in thermal processes to minimize undesired cracking in catalytic cracking processes.

Gartside also asserts that the '235 patent teaches away from applying the process disclosed in the '645 patent to catalytic reactions. This contention is without merit. Gartside cites the following language from the '235 patent:

> In some reaction systems, specifically catalytic reactions at low or moderate temperatures, quench of the product gas is undesirable from a process standpoint. In other cases, the quench is ineffective in terminating the reaction. Thus, these reaction systems require immediate separation of the phases to remove catalyst from the gas phases. Once the catalyst is removed, the mechanism for reaction is no longer present.

'235 patent, col. 1, ll. 49–56. As the Board found, however, this portion of the specification addresses the undesirability of a quench used in catalytic reactions at *low to moderate* temperatures, not the high temperature reactions at issue in the '645 patent, and teaches that in other undefined systems, quenching is ineffective. *See Gartside*, Paper No. 72 at 16. That is not a clear "teaching away" from use of a quench in all catalytic systems. Accordingly, substantial evidence supports the Board's finding that this disclosure does not teach away from the claimed invention. *See id.* at 16–17.

Having concluded that the Board's factual findings relating to its § 103 analysis are supported by substantial evidence, we further conclude that the Board did not err as a matter of law that claims 34, 35, 37–40, 42–44 and 47 are invalid as obvious. We have carefully considered Gartside's additional arguments but find them unpersuasive.

D. *Patentability of Claims 41, 45 and 46*

[15] Gartside argues that the Board erred in its *sua sponte* holding that claims 41, 45, and 46 are unpatentable under § 103 based on the '645 patent in view of the Castaghos patent, or on those two patents in view of the '235 patent. Gartside contends that the Board erred in combining those patents, because there was no teaching or suggestion to use a 0.1 to 0.6 second kinetic residence time in a catalytic cracking process. Gartside further argues that his showing of unexpected results, as described in the second Johnson Declaration, constitutes a secondary consideration weighing in favor of nonobviousness, and that the Board erred in discounting those results. The Commissioner responds that the Board correctly held that the claims were unpatentable, arguing that the motivation to combine the references arose from the references themselves, as well as the nature of the problem to be solved, *viz.*, maximizing reaction conditions in cracking processes by minimizing residence time. The Commissioner further contends that Gartside's evidence of unexpected results is not probative of nonobviousness, as the examples disclosed in the second Johnson Declaration do not correspond to any process within the scope of the claims at issue.

We agree with the Commissioner that substantial evidence supports the Board's

finding that a motivation to combine the '645, '235, and Castagnos patents arose from the teachings of the references themselves and the nature of the problem to be solved.[10] As the Board found, use of low residence times to arrest undesired cracking in the '645 and '235 patents was part of a "trend in the art towards short residence times." *Gartside*, Paper No. 72 at 27; see '645 patent, col. 1, ll. 61–67 (disclosing residence times of between 0.05 to 0.4 seconds); '235 patent, title ("LOW RESIDENCE TIME SOLID-GAS SEPARATION DEVICE AND SYSTEM") and col. 7, ll. 26–31 (disclosing that adjustment of the claimed apparatus may yield residence times of 0.1 and 0.5 seconds). In view of this trend, one of ordinary skill who was attempting to minimize undesired cracking reactions would have been directed by these two patents to the Castagnos patent, which describes low residence time catalytic reactions and which discloses the precise residence time in the disputed claims. *See* Castagnos patent, col. 2, ll. 6–12 (disclosing residence times of "about 0.1 to about 1 second"). Accordingly, we conclude that substantial evidence supports the Board's finding that a motivation existed to combine these patents to obtain the invention claimed in claims 41, 45, and 46.

Gartside also argues that the Board erred in finding that the second Johnson declaration, which allegedly contains evidence of unexpected results,[11] did not weigh in favor of the patentability of claims 41, 45, and 46. We disagree. The Board essentially adopted the APJ's order to show cause as it pertained to the second Johnson declaration, finding that the process recited in the declaration failed to reproduce the separation and quenching steps of the claimed process. *See Gartside*, Paper No. 72 at 35–36. This finding is supported by the declarant's own statements, which reveal that the quench in the declaration experiment *preceded* the separation of product from catalyst. *See* Paper No. 48 at 3, ¶ 9. Accordingly, we agree with the Commissioner that substantial evidence supports the Board's finding that the examples in the declaration do not correspond to any process within the scope of the claims, and the declaration is therefore not probative of nonobviousness. *See Gartside*, Paper No. 72 at 35–36.

In summary, we conclude that all of the Board's disputed factfindings are supported by substantial evidence and that the Board did not err as a matter of law in holding that claims 41, 45, and 46 are invalid under § 103.[12]

CONCLUSION

The Board did not err in maintaining jurisdiction over the interference proceeding despite the withdrawal of the junior party, and further did not err in deciding the patentability of Gartside's claims that corresponded to the count. To the extent that the Board's decision to resolve the patentability issues surrounding claims 41, 45, and 46 under § 135(a) was discretion-

10. The Board did not perform a separate "motivation to combine" analysis, but incorporated the reasoning from its conclusion that claims 41, 45, and 46 were not patentably distinct from Gartside's other claims that corresponded to the count. *See Gartside*, Paper No. 72 at 25–29.

11. According to the second Johnson declaration, these unexpected results include a 5% increase in gasoline yield and considerably less undesired dry gas and liquefied petroleum. *See* Paper No. 48 at 8, ¶¶ 19–21.

12. We will only briefly note Gartside's contention that the Board erred in even addressing the patentability of these claims. We agree with the Commissioner that the Board properly upheld the APJ's denial of Gartside's motion to redesignate these claims as not corresponding to the count. *See Gartside*, Paper No. 72 at 28. In short, we agree with the Board that these claims are not patentably distinct from the other claims corresponding to the count for the same reasons that these claims are unpatentable under § 103.

ary, the Board did not abuse its discretion. As for the patentability of claims 34, 35, and 37–47, all of the Board's disputed factual findings relating to its obviousness analysis are supported by substantial evidence, and we find no error in the Board's conclusion that the claims are unpatentable as obvious as a matter of law.

Accordingly, we

AFFIRM.

In re SANG-SU LEE.

No. 00-1158.

United States Court of Appeals, Federal Circuit.

Jan. 18, 2002.

Board of Patent Appeals and Interferences rejected all claims of inventor's patent application directed toward method of automatically displaying functions of video display device that demonstrated how to select and adjust functions in order to facilitate response by user. Inventor appealed. The Court of Appeals, Pauline Newman, Circuit Judge, held that analysis by Board did not comport with either legal requirements for determination of obviousness or with requirements of Administrative Procedure Act (APA).

Vacated and remanded.

1. Patents ⇐113(6)

Tribunals of the Patent and Trademark Office (PTO) are governed by the Administrative Procedure Act (APA), and their rulings receive the same judicial deference as do tribunals of other administrative agencies. 5 U.S.C.A. § 551 et seq.

2. Administrative Law and Procedure ⇐485, 507

For judicial review to be meaningfully achieved within the strictures of the Administrative Procedures Act (APA), an agency tribunal must present a full and reasoned explanation of its decision; the agency tribunal must set forth its findings and the grounds thereof, as supported by the agency record, and explain its application of the law to the found facts. 5 U.S.C.A. § 706(2).

3. Patents ⇐113(6)

Judicial review of a decision of the Board of Patent Appeals and Interferences denying an application for a patent is founded on the obligation of the agency to make the necessary findings and to provide an administrative record showing the evidence on which the findings are based, accompanied by the agency's reasoning in reaching its conclusions. 5 U.S.C.A. § 551 et seq.

4. Patents ⇐31.1

As applied to the determination of patentability vel non, when the issue is obviousness, it is fundamental that the rejection of a patent application must be based on evidence comprehended by the language of the statute addressing obviousness. 35 U.S.C.A. § 103.

5. Patents ⇐16.5(1)

The patent examination process centers on prior art and the analysis thereof; when patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness. 35 U.S.C.A. § 103.

6. Patents ⇐26(1)

In the context of an obviousness determination by the Board of Patent Appeals and Interferences, the factual inquiry whether to combine references must be thorough and searching; it must be based on objective evidence of record. 35 U.S.C.A. § 103.

7. Patents ⇐111

Analysis of invention by Board of Patent Appeals and Interferences did not comport with either legal requirements for determination of obviousness or with requirements of Administrative Procedure Act (APA) on basis that agency tribunal did not set forth findings and explanations needed for reasoned decisionmaking; examiner used conclusory statements to support his subjective belief that it was obvi-

ous that person skilled in the art would have been motivated to combine prior art, and Board rejected need for any specific hint or suggestion in particular reference to support combination of prior art. 5 U.S.C.A. § 706(2); 35 U.S.C.A. § 103.

8. Patents ⇐26(1)

In an obviousness determination, the factual question of motivation to combine prior art is material to patentability, and cannot be resolved on subjective belief and unknown authority. 35 U.S.C.A. § 103.

9. Patents ⇐26(1), 111

In an obviousness determination under patent law, it is improper, in determining whether a person of ordinary skill would have been led to combine references, simply to use that which the inventor taught against its teacher; thus, the Board of Patent Appeals and Interferences must not only assure that the requisite findings are made, based on evidence of record, but must also explain the reasoning by which the findings are deemed to support the agency's conclusion. 5 U.S.C.A. § 706(2); 35 U.S.C.A. § 103.

10. Administrative Law and Procedure ⇐507

Deferential judicial review under the Administrative Procedure Act (APA) does not relieve the agency of its obligation to develop an evidentiary basis for its findings; to the contrary, the APA reinforces this obligation. 5 U.S.C.A. § 706(2).

11. Administrative Law and Procedure ⇐763, 796

In the context of judicial review under the Administrative Procedure Act (APA), a decision by an agency tribunal that has an omission of a relevant factor required by precedent is both legal error and "arbitrary agency action." 5 U.S.C.A. § 551 et seq.

See publication Words and Phrases for other judicial constructions and definitions.

12. Administrative Law and Procedure ⇐485, 760

The foundation of the principle of judicial deference under the Administrative Procedures Act (APA) to the rulings of agency tribunals is that the tribunal has specialized knowledge and expertise such that when reasoned findings are made, a reviewing court may confidently defer to the agency's application of its knowledge in its area of expertise; however, reasoned findings are critical to the performance of agency functions and judicial reliance on agency competence. 5 U.S.C.A. § 706(2).

13. Patents ⇐16(1)

The determination of patentability on the ground of unobviousness is ultimately one of judgment; in furtherance of the judgmental process, the patent examination procedure serves both to find, and to place on the official record, that which has been considered with respect to patentability. 35 U.S.C.A. § 103.

14. Patents ⇐16(3), 104, 111

In the context of an obviousness determination, the patent examiner and the Board of Patent Appeals and Interferences are deemed to have experience in the field of the invention; however, this experience, insofar as applied to the determination of patentability, must be applied from the viewpoint of the person having ordinary skill in the art to which said subject matter pertains. 35 U.S.C.A. § 103.

15. Patents ⇐104

In finding the relevant facts, in assessing the significance of the prior art, and in making the ultimate determination of the issue of obviousness, the examiner and the Board of Patent Appeals and Interferences are presumed to act from the viewpoint of a person having ordinary skill in the art to which the subject matter pertains; thus, when they rely on what they assert to be general knowledge to

negate patentability, that knowledge must be articulated and placed on the record and the failure to do so is not consistent with either effective administrative procedure or effective judicial review. 5 U.S.C.A. § 706(2); 35 U.S.C.A. § 103.

16. Patents ⇐111

In the context of an obviousness determination, the Board of Patent Appeals and Interferences cannot rely on conclusory statements when dealing with particular combinations of prior art and specific claims, but must set forth the rationale on which it relies. 5 U.S.C.A. § 706(2); 35 U.S.C.A. § 103.

17. Administrative Law and Procedure ⇐326, 485, 507

Sound administrative procedure requires that an agency apply the law in accordance with statute and precedent; the agency tribunal must make findings of relevant facts, and present its reasoning in sufficient detail that the court may conduct meaningful review of the agency action. 5 U.S.C.A. § 706(2).

Richard H. Stern, of Washington, DC, argued for Sang Su Lee. With him on the brief was Robert E. Bushnell.

Sidney O. Johnson, Jr., Associate Solicitor, of Arlington, Virginia, argued for the Director of the U.S. Patent and Trademark Office. With him on the brief were John M. Whealan, Solicitor, and Raymond T. Chen, Associate Solicitor. Of counsel were Maximilian R. Peterson and Mark Nagumo, Associate Solicitors.

Before PAULINE NEWMAN, CLEVENGER, and DYK, Circuit Judges.

PAULINE NEWMAN, Circuit Judge.

Sang-Su Lee appeals the decision of the Board of Patent Appeals and Interferences of the United States Patent and Trademark Office, rejecting all of the claims of Lee's patent application Serial No. 07/631,210 entitled "Self-Diagnosis and Sequential-Display Method of Every Function."[1] We vacate the Board's decision for failure to meet the adjudicative standards for review under the Administrative Procedure Act, and remand for further proceedings.

The Prosecution Record

Mr. Lee's patent application is directed to a method of automatically displaying the functions of a video display device and demonstrating how to select and adjust the functions in order to facilitate response by the user. The display and demonstration are achieved using computer-managed electronics, including pulse-width modulation and auto-fine-tuning pulses, in accordance with procedures described in the specification. Claim 10 is representative:

10. A method for automatically displaying functions of a video display device, comprising:

determining if a demonstration mode is selected;

if said demonstration mode is selected, automatically entering a picture adjustment mode having a picture menu screen displaying a list of a plurality of picture functions; and

automatically demonstrating selection and adjustment of individual ones of said plurality of picture functions.

The examiner rejected the claims on the ground of obviousness, citing the combination of two references: United States Patent No. 4,626,892 to Nortrup, and the Thunderchopper Helicopter Operations

1. *Ex parte Lee*, No. 1994-1989 (Bd. Pat. App. & Int. Aug. 30, 1994; on reconsid'n Sept. 29, 1999).

Handbook for a video game. The Nortrup reference describes a television set having a menu display by which the user can adjust various picture and audio functions; however, the Nortrup display does not include a demonstration of how to adjust the functions. The Thunderchopper Handbook describes the Thunderchopper game's video display as having a "demonstration mode" showing how to play the game; however, the Thunderchopper Handbook makes no mention of the adjustment of picture or audio functions. The examiner held that it would have been obvious to a person of ordinary skill to combine the teachings of these references to produce the Lee system.

Lee appealed to the Board, arguing that the Thunderchopper Handbook simply explained how to play the Thunderchopper game, and that the prior art provided no teaching or motivation or suggestion to combine this reference with Nortrup, or that such combination would produce the Lee invention. The Board held that it was not necessary to present a source of a teaching, suggestion, or motivation to combine these references or their teachings. The Board stated:

> The conclusion of obviousness may be made from common knowledge and common sense of a person of ordinary skill in the art without any specific hint or suggestion in a particular reference.

Board op. at 7. The Board did not explain the "common knowledge and common sense" on which it relied for its conclusion that "the combined teachings of Nortrup and Thunderchopper would have suggested the claimed invention to those of ordinary skill in the art."

Lee filed a request for reconsideration, to which the Board responded after five years. The Board reaffirmed its decision, stating that the Thunderchopper Handbook was "analogous art" because it was "from the same field of endeavor" as the Lee invention, and that the field of video games was "reasonably pertinent" to the problem of adjusting display functions because the Thunderchopper Handbook showed video demonstrations of the "features" of the game. On the matter of motivation to combine the Nortrup and Thunderchopper references, the Board stated that "we maintain the position that we stated in our prior decision" and that the Examiner's Answer provided "a well reasoned discussion of why there is sufficient motivation to combine the references." The Board did not state the examiner's reasoning, and review of the Examiner's Answer reveals that the examiner merely stated that both the Nortrup function menu and the Thunderchopper demonstration mode are program features and that the Thunderchopper mode "is user-friendly" and it functions as a tutorial, and that it would have been obvious to combine them.

Lee had pressed the examiner during prosecution for some teaching, suggestion, or motivation in the prior art to select and combine the references that were relied on to show obviousness. The Examiner's Answer before the Board, plus a Supplemental Answer, stated that the combination of Thunderchopper with Nortrup "would have been obvious to one of ordinary skill in the art since the demonstration mode is just a programmable feature which can be used in many different device[s] for providing automatic introduction by adding the proper programming software," and that "another motivation would be that the automatic demonstration mode is user friendly and it functions as a tutorial." The Board adopted the examiner's answer, stating "the examiner has provided a well reasoned discussion of these references and how the combination of these references meets the claim limitations." However, perhaps recognizing that the examiner had provided insufficient justification to

support combining the Nortrup and Thunderchopper references, the Board held, as stated *supra*, that a "specific hint or suggestion" of motivation to combine was not required.

This appeal followed.

Judicial Review

[1] Tribunals of the PTO are governed by the Administrative Procedure Act, and their rulings receive the same judicial deference as do tribunals of other administrative agencies. *Dickinson v. Zurko*, 527 U.S. 150, 119 S.Ct. 1816, 144 L.Ed.2d 143, 50 USPQ2d 1930 (1999). Thus on appeal we review a PTO Board's findings and conclusions in accordance with the following criteria:

> 5 U.S.C. § 706(2) The reviewing court shall—
>
> (2) hold unlawful and set aside agency actions, findings, and conclusions found to be—
>
> (A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law;
>
> * * * * * *
>
> (E) unsupported by substantial evidence in a case subject to sections 556 and 557 of this title or otherwise reviewed on the record of an agency hearing provided by statute;

[2, 3] For judicial review to be meaningfully achieved within these strictures, the agency tribunal must present a full and reasoned explanation of its decision. The agency tribunal must set forth its findings and the grounds thereof, as supported by the agency record, and explain its application of the law to the found facts. The Court has often explained:

> The Administrative Procedure Act, which governs the proceedings of administrative agencies and related judicial review, establishes a scheme of "reasoned decisionmaking." Not only must an agency's decreed result be within the scope of its lawful authority, but the process by which it reaches that result must be logical and rational.

Allentown Mack Sales and Service, Inc. v. National Labor Relations Bd., 522 U.S. 359, 374, 118 S.Ct. 818, 139 L.Ed.2d 797 (1998) (citation omitted). This standard requires that the agency not only have reached a sound decision, but have articulated the reasons for that decision. The reviewing court is thus enabled to perform meaningful review within the strictures of the APA, for the court will have a basis on which to determine "whether the decision was based on the relevant factors and whether there has been a clear error of judgment." *Citizens to Preserve Overton Park v. Volpe*, 401 U.S. 402, 416, 91 S.Ct. 814, 28 L.Ed.2d 136 (1971). Judicial review of a Board decision denying an application for patent is thus founded on the obligation of the agency to make the necessary findings and to provide an administrative record showing the evidence on which the findings are based, accompanied by the agency's reasoning in reaching its conclusions. *See In re Zurko*, 258 F.3d 1379, 1386, 59 USPQ2d 1693, 1697 (Fed.Cir.2001) (review is on the administrative record); *In re Gartside*, 203 F.3d 1305, 1314, 53 USPQ2d 1769, 1774 (Fed.Cir. 2000) (Board decision "must be justified within the four corners of the record").

[4, 5] As applied to the determination of patentability *vel non* when the issue is obviousness, "it is fundamental that rejections under 35 U.S.C. § 103 must be based on evidence comprehended by the language of that section." *In re Grasselli*, 713 F.2d 731, 739, 218 USPQ 769, 775 (Fed.Cir.1983). The essential factual evidence on the issue of obviousness is set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17–18, 86 S.Ct. 684, 15 L.Ed.2d 545, 148 USPQ 459, 467 (1966) and extensive ensuing precedent. The patent examina-

tion process centers on prior art and the analysis thereof. When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness. *See, e.g., McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351–52, 60 USPQ2d 1001, 1008 (Fed.Cir.2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the *Graham* factors).

[6] The factual inquiry whether to combine references must be thorough and searching." *Id.* It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with. *See, e.g., Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1124–25, 56 USPQ2d 1456, 1459 (Fed.Cir.2000) ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an 'essential component of an obviousness holding' ") (quoting *C.R. Bard, Inc., v. M3 Systems, Inc.*, 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed.Cir. 1998)); *In re Dembiczak*, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed.Cir.1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."); *In re Dance*, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed.Cir.1998) (there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant); *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed.Cir. 1988) ("teachings of references can be combined *only* if there is some suggestion or incentive to do so.") (emphasis in original) (quoting *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed.Cir.1984)).

The need for specificity pervades this authority. *See, e.g., In re Kotzab*, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir.2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed"); *In re Rouffet*, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed.Cir. 1998) ("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious."); *In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed.Cir.1992) (the examiner can satisfy the burden of showing obviousness of the combination "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references").

[7–9] With respect to Lee's application, neither the examiner nor the Board adequately supported the selection and combination of the Nortrup and Thunderchopper references to render obvious that which Lee described. The examiner's conclusory statements that "the demonstration mode is just a programmable feature which can be used in many different device[s] for providing automatic introduction by adding the proper programming software" and that "another motivation would be that the automatic demonstration mode is user friendly and it functions as a tutorial" do not adequately address the issue of motivation to combine. This factual question

of motivation is material to patentability, and could not be resolved on subjective belief and unknown authority. It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." *W.L. Gore v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 312–13 (Fed.Cir.1983). Thus the Board must not only assure that the requisite findings are made, based on evidence of record, but must also explain the reasoning by which the findings are deemed to support the agency's conclusion.

[10] Deferential judicial review under the Administrative Procedure Act does not relieve the agency of its obligation to develop an evidentiary basis for its findings. To the contrary, the Administrative Procedure Act reinforces this obligation. *See, e.g., Motor Vehicle Manufacturers Ass'n v. State Farm Mutual Automobile Ins. Co.*, 463 U.S. 29, 43, 103 S.Ct. 2856, 77 L.Ed.2d 443 (1983) ("the agency must examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'") (quoting *Burlington Truck Lines v. United States*, 371 U.S. 156, 168, 83 S.Ct. 239, 9 L.Ed.2d 207 (1962)); *Securities & Exchange Comm'n v. Chenery Corp.*, 318 U.S. 80, 94, 63 S.Ct. 454, 87 L.Ed. 626 (1943) ("The orderly function of the process of review requires that the grounds upon which the administrative agency acted are clearly disclosed and adequately sustained.").

[11] In its decision on Lee's patent application, the Board rejected the need for "any specific hint or suggestion in a particular reference" to support the combination of the Nortrup and Thunderchopper references. Omission of a relevant factor required by precedent is both legal error and arbitrary agency action. *See Motor Vehicle Manufacturers*, 463 U.S. at 43, 103 S.Ct. 2856 ("an agency rule would be arbitrary and capricious if the agency ... entirely failed to consider an important aspect of the problem"); *Mullins v. Department of Energy*, 50 F.3d 990, 992 (Fed.Cir.1995) ("It is well established that agencies have a duty to provide reviewing courts with a sufficient explanation for their decisions so that those decisions may be judged against the relevant statutory standards, and that failure to provide such an explanation is grounds for striking down the action."). As discussed in *National Labor Relations Bd. v. Ashkenazy Property Mgt. Corp.*, 817 F.2d 74, 75 (9th Cir.1987), an agency is "not free to refuse to follow circuit precedent."

[12] The foundation of the principle of judicial deference to the rulings of agency tribunals is that the tribunal has specialized knowledge and expertise, such that when reasoned findings are made, a reviewing court may confidently defer to the agency's application of its knowledge in its area of expertise. Reasoned findings are critical to the performance of agency functions and judicial reliance on agency competence. *See Baltimore and Ohio R.R. Co. v. Aberdeen & Rockfish R.R. Co.*, 393 U.S. 87, 91–92, 89 S.Ct. 280, 21 L.Ed.2d 219 (1968) (absent reasoned findings based on substantial evidence effective review would become lost "in the haze of so-called expertise"). The "common knowledge and common sense" on which the Board relied in rejecting Lee's application are not the specialized knowledge and expertise contemplated by the Administrative Procedure Act. Conclusory statements such as those here provided do not fulfill the agency's obligation. This court explained in *Zurko*, 258 F.3d at 1385, 59 USPQ2d at 1697, that "deficiencies of the cited references cannot be remedied by the Board's general conclusions about what is 'basic knowledge' or 'common sense.'" The

Board's findings must extend to all material facts and must be documented on the record, lest the "haze of so-called expertise" acquire insulation from accountability. "Common knowledge and common sense," even if assumed to derive from the agency's expertise, do not substitute for authority when the law requires authority. *See Allentown Mack*, 522 U.S. at 376, 118 S.Ct. 818 ("Because reasoned decisionmaking demands it, and because the systemic consequences of any other approach are unacceptable, the Board must be required to apply in fact the clearly understood legal standards that it enunciates in principle.")

The case on which the Board relies for its departure from precedent, *In re Bozek*, 57 C.C.P.A. 713, 416 F.2d 1385, 163 USPQ 545 (1969), indeed mentions "common knowledge and common sense," the CCPA stating that the phrase was used by the Solicitor to support the Board's conclusion of obviousness based on evidence in the prior art. *Bozek* did not hold that common knowledge and common sense are a substitute for evidence, but only that they may be applied to analysis of the evidence. *Bozek* did not hold that objective analysis, proper authority, and reasoned findings can be omitted from Board decisions. Nor does *Bozek*, after thirty-two years of isolation, outweigh the dozens of rulings of the Federal Circuit and the Court of Customs and Patent Appeals that determination of patentability must be based on evidence. This court has remarked, in *Smiths Industries Medical Systems, Inc. v. Vital Signs, Inc.*, 183 F.3d 1347, 1356, 51 USPQ2d 1415, 1421 (Fed.Cir.1999), that *Bozek*'s reference to common knowledge "does not in and of itself make it so" absent evidence of such knowledge.

[13–16] The determination of patentability on the ground of unobviousness is ultimately one of judgment. In furtherance of the judgmental process, the patent examination procedure serves both to find, and to place on the official record, that which has been considered with respect to patentability. The patent examiner and the Board are deemed to have experience in the field of the invention; however, this experience, insofar as applied to the determination of patentability, must be applied from the viewpoint of "the person having ordinary skill in the art to which said subject matter pertains," the words of section 103. In finding the relevant facts, in assessing the significance of the prior art, and in making the ultimate determination of the issue of obviousness, the examiner and the Board are presumed to act from this viewpoint. Thus when they rely on what they assert to be general knowledge to negate patentability, that knowledge must be articulated and placed on the record. The failure to do so is not consistent with either effective administrative procedure or effective judicial review. The board cannot rely on conclusory statements when dealing with particular combinations of prior art and specific claims, but must set forth the rationale on which it relies.

Alternative Grounds

At oral argument the PTO Solicitor proposed alternative grounds on which this court might affirm the Board's decision. However, as stated in *Burlington Truck Lines, Inc. v. United States*, 371 U.S. 156, 168, 83 S.Ct. 239, 9 L.Ed.2d 207 (1962), "courts may not accept appellate counsel's *post hoc* rationalization for agency action." Consideration by the appellate tribunal of new agency justifications deprives the aggrieved party of a fair opportunity to support its position; thus review of an administrative decision must be made on the grounds relied on by the agency. "If those grounds are inadequate or improper, the court is powerless to affirm the administrative action by substituting what it con-

siders to be a more adequate or proper basis." *Securities & Exchange Comm'n v. Chenery Corp.*, 332 U.S. 194, 196, 67 S.Ct. 1575, 91 L.Ed. 1995 (1947). As reiterated in *Federal Election Comm'n v. Akins*, 524 U.S. 11, 25, 118 S.Ct. 1777, 141 L.Ed.2d 10 (1998), "If a reviewing court agrees that the agency misinterpreted the law, it will set aside the agency's action and remand the case—even though the agency (like a new jury after a mistrial) might, later, in the exercise of its lawful discretion, reach the same result for a different reason." Thus we decline to consider alternative grounds that might support the Board's decision.

Further Proceedings

[17] Sound administrative procedure requires that the agency apply the law in accordance with statute and precedent. The agency tribunal must make findings of relevant facts, and present its reasoning in sufficient detail that the court may conduct meaningful review of the agency action. In *Radio–Television News Directors Ass'n v. FCC*, 184 F.3d 872 (D.C.Cir.1999) the court discussed the "fine line between agency reasoning that is 'so crippled as to be unlawful' and action that is potentially lawful but insufficiently or inappropriately explained," quoting from *Checkosky v. Securities & Exch. Comm'n*, 23 F.3d 452, 464 (D.C.Cir.1994); the court explained that "[i]n the former circumstance, the court's practice is to vacate the agency's order, while in the latter the court frequently remands for further explanation (including discussion of the relevant factors and precedents) while withholding judgment on the lawfulness of the agency's proposed action." *Id.* at 888. In this case the Board's analysis of the Lee invention does not comport with either the legal requirements for determination of obviousness or with the requirements of the Administrative Procedure Act that the agency tribunal set forth the findings and explanations needed for "reasoned decisionmaking." Remand for these purposes is required. *See Overton Park*, 401 U.S. at 420–421, 91 S.Ct. 814 (remanding for further proceedings appropriate to the administrative process).

VACATED AND REMANDED.